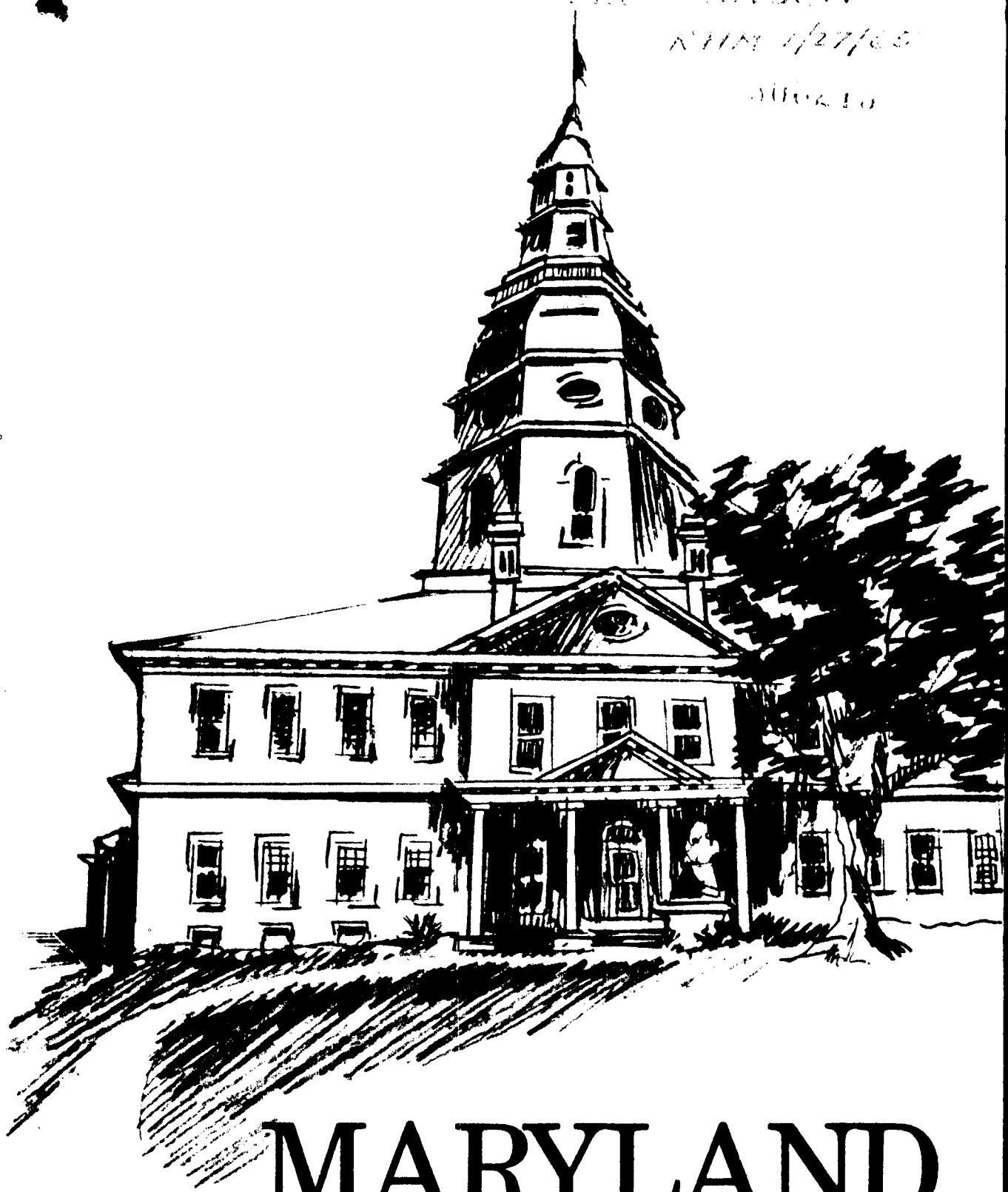


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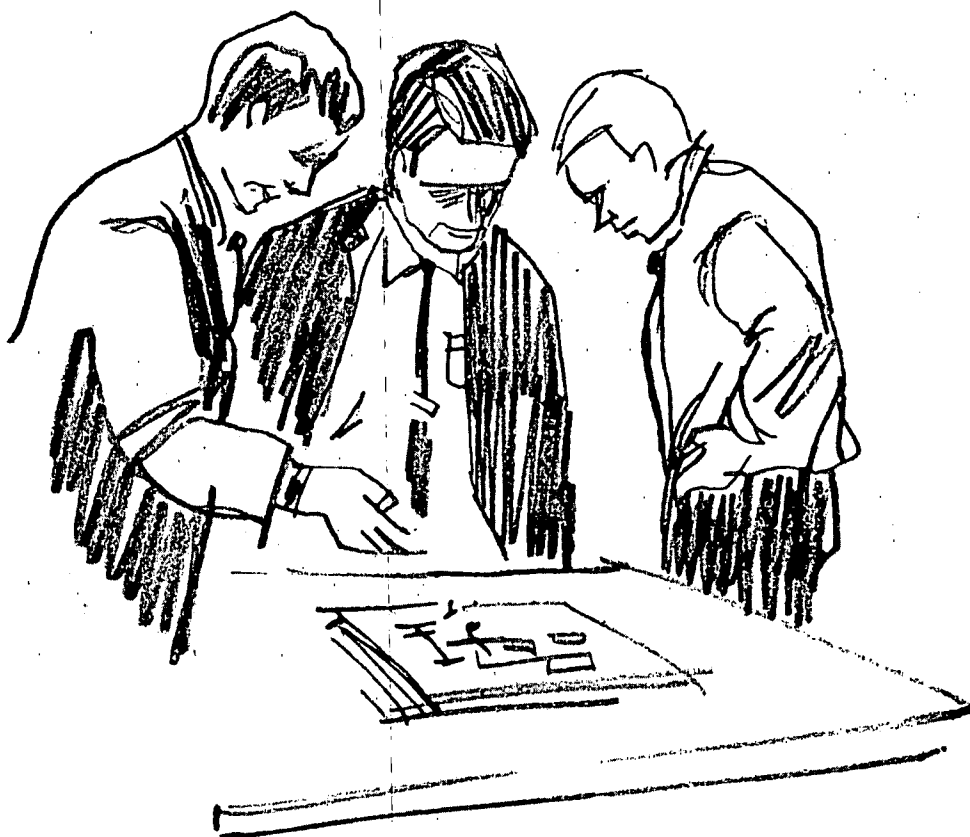
MARYLAND HIGHWAY MANAGEMENT

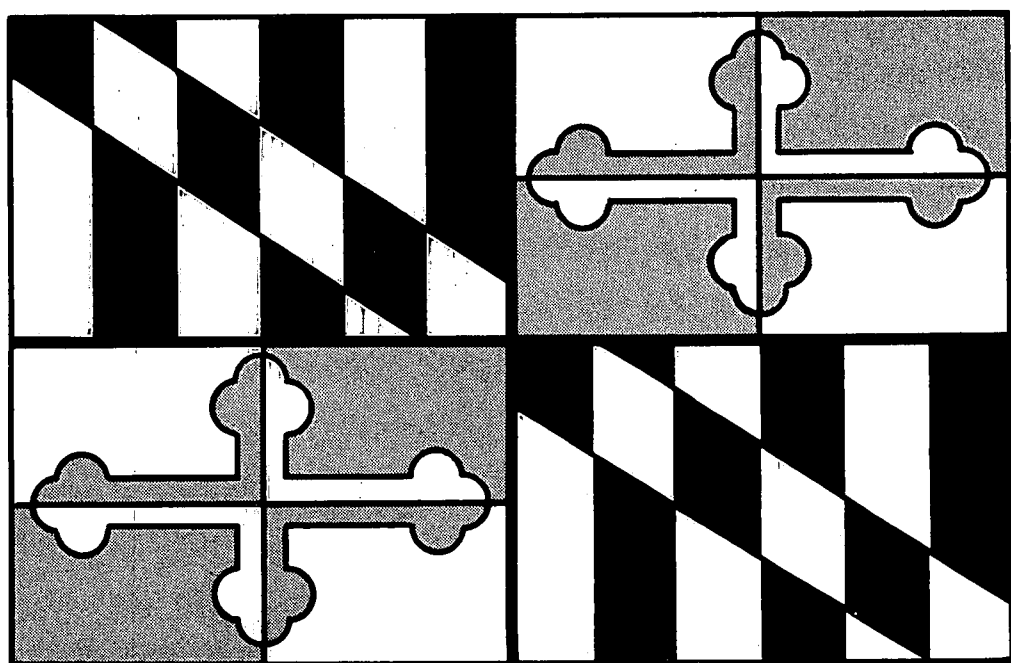
MARYLAND HIGHWAY MANAGEMENT

a report to the GOVERNOR
and the GENERAL ASSEMBLY

prepared by
ROY JORGENSEN AND ASSOCIATES
HIGHWAY ENGINEERING
AND MANAGEMENT CONSULTANTS
GAITHERSBURG, MARYLAND

JANUARY 1965





ROY JORGENSEN AND ASSOCIATES
Highway Engineering and Management Consultants

January 1, 1965

POST OFFICE BOX 575
GAITHERSBURG, MARYLAND

Honorable J. Millard Tawes, Governor
and Members of the General Assembly
State of Maryland
State Capital
Annapolis, Maryland

Gentlemen:

We are pleased to submit this report on our review and appraisal of the Maryland State Roads Commission.

This study was conducted in compliance with Senate Bill No. 2 of the 1964 Special Session of the General Assembly and in accordance with the agreement between the State and our organization of highway engineering and management consultants.


The study involved analysis of the organizational structure, performance, personnel practices, operating procedures, administration and financing procedures of the Commission.

This type of critical review by an outside agency has become an accepted practice of forward-looking businesses — both public and private. In no sense should the emphasis on needed changes or new approaches be viewed other than as constructive suggestions to an organization bent on self-improvement.

It is suggested that implementation of the recommendations contained in the report be done on a deliberately scheduled basis. While some recommendations might be readily effected, others are of a nature that will require considerable time and careful scheduling.

We appreciate this opportunity to work for the State of Maryland, and gratefully acknowledge the cooperation extended to us by the members and staff of the Commission.

Sincerely yours,


ROY E. JORGENSEN

ROY JORGENSEN AND ASSOCIATES
staff for Maryland study

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AUTHORIZATION FOR STUDY

Senate Bill No. 2, Section 7, Special Session of 1964

Approved: April 17, 1964

And be it further enacted, That the Governor of Maryland, as soon as reasonably possible after the enactment of this Act, shall employ a competent and impartial firm of management consultants to conduct a thorough and complete study of the structure, efficiency, personnel, operational procedures, administration, and financing procedures of the State Roads Commission; and the Governor shall direct this firm of management consultants to submit to him and to the General Assembly a complete report on these studies not later than January 1, 1965. The cost of this study shall not exceed seventy-five thousand dollars (\$75,000.00).

In compliance with the provisions of Senate Bill No. 2, an agreement was made and entered on July 13, 1964, by and between the State of Maryland and Roy Jorgensen and Associates.

State of Maryland

J. MILLARD TAWES, GOVERNOR

WILLIAM S. JAMES, PRESIDENT OF THE SENATE

MARVIN MANDEL, SPEAKER, HOUSE OF DELEGATES

STATE ROADS COMMISSION

JOHN B. FUNK	● Chairman-Director
PAUL J. BAILEY	● Commissioner
HARLEY P. BRINSFIELD	● Commissioner
WILLIAM B. OWINGS	● Commissioner
LANSDALE G. CLAGETT	● Commissioner
LESLIE H. EVANS	● Commissioner
JOHN J. McMULLEN	● Commissioner
WALTER E. WOODFORD	● Study Coordinator

FOREWORD

This report is the result of a comprehensive review of the Maryland State Roads Commission — its structure, efficiency, personnel, operations, administration and financing procedures.

The purpose of the report is to provide the Governor and the General Assembly with an evaluation of the Commission's performance, to point out problem areas and specific factors affecting performance, and to recommend legislative and administrative actions designed to improve the Commission's operations and performance.

To facilitate a complete and thorough study within the time provided, the Consultant established and staffed a residency office in Baltimore adjacent to the Commission's headquarters.

Specific functions and processes considered essential to the development, operation and maintenance of an adequate state highway system were determined early in the study. Within each function or process, objectives were defined and a framework established as a basis for appraising the Commission's structure, staffing, operations and performance.

Evaluations were made through review and analysis of historical data and statutory requirements; interviews with Commission members; conferences with Commission central office and district personnel; observations at Commission meetings; discussions with legislators, officials of the U. S. Bureau of Public Roads and representatives of the Maryland Highway Contractors Association; and on the basis of the Consultant's experience in studies of a similar nature for other state highway agencies.

Results of the research and analysis carried out during the study are presented herein as follows:

Part One provides a broad picture of the total performance of the Commission as reflected by its ability effectively to accomplish the goals and objectives for which it was created.

Part Two enumerates the general areas in which problems were found, evaluates specific factors affecting operations and performance, and presents recommendations for improvement.

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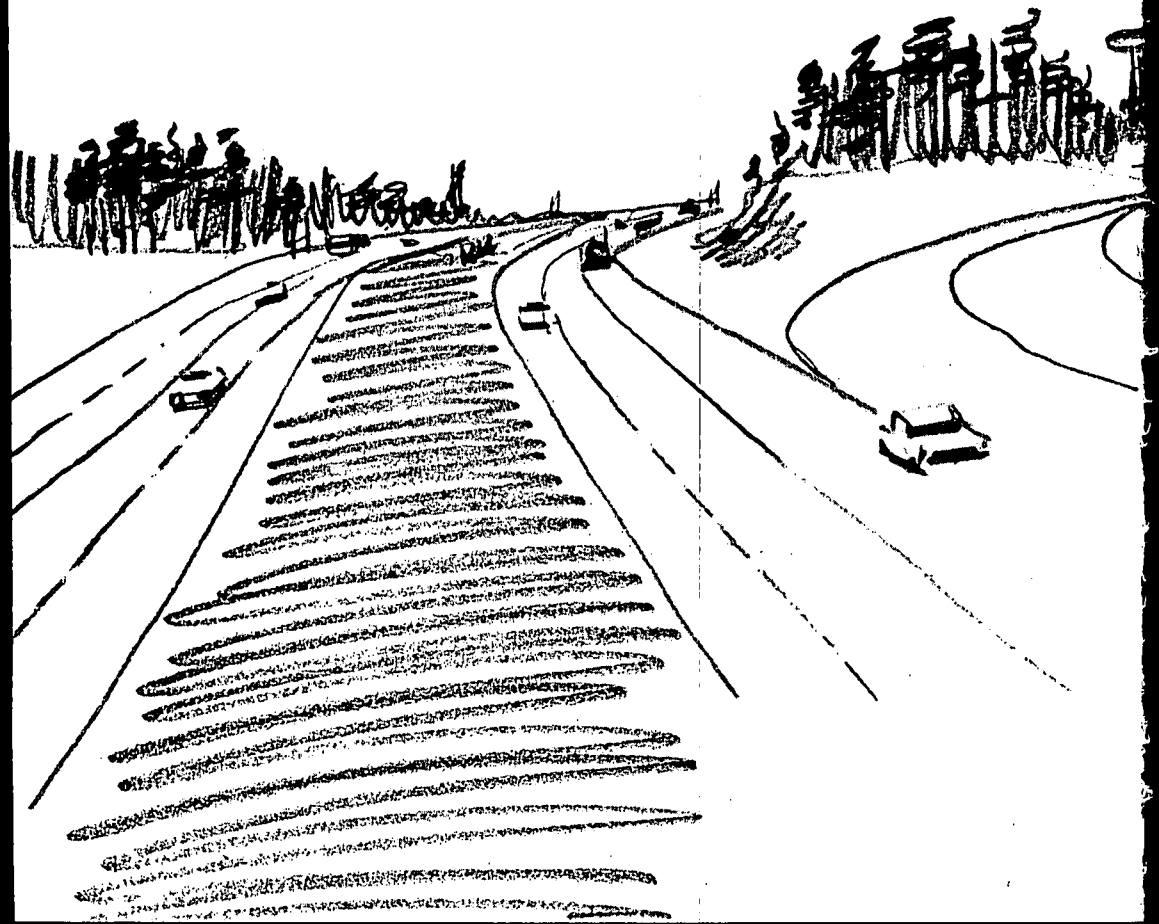
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SYNOPSIS



The major problems in the Maryland State Roads Commission can be attributed to a lack of fully effective planning, programming and scheduling for the development and operation of the State Highway System.

This report defines the specific problems that exist in the different areas of Commission activity. It points out the need for modification of legislation affecting highway planning and programming. It suggests changes in the organizational structure and relationships in the Commission to facilitate the definition and attainment of desirable objectives.

The principal recommendations are outlined below, along with indicated actions for implementation. Recommendations and supporting data are discussed in detail in Parts One and Two of the report.

- There should be vested in the Commission full responsibility and authority for planning, developing and operating the State Highway System.

This will require action by the General Assembly to amend existing legislation with regard to the programming authority of the Commission. It will permit immediate action by the Commission to establish a realistic programming and scheduling process for the accomplishment of highway improvements. (See pages 34-38 and 101-102.)

- The General Assembly should revise legislation with regard to the organizational structure of the Commission to provide a single authority responsible for the State Highway System.

The new legislation should create a three-member policy-making Commission body and provide for appointment of a Director of Highways and a Deputy Director to administer and manage the operating organization. (See pages 92-98 and 101-104.)

- The Commission should modify the framework of the operating organization to effect a better grouping of functional units.

This should involve the establishment of five major functional units responsible for development, operations, administration, finance and toll facilities. (See pages 98-101 and 104-107.)

- There should be established a continuous, comprehensive highway planning process in the Commission.

This should encompass (1) a long-range plan for complete development of the State Highway System fully coordinated with road and street plans of local jurisdictions, (2) a continuously updated five-year highway construction program, and (3) a multiple-project scheduling system. The General Assembly should express legislative intent for the Commission to carry on this type of planning process, but the manner of doing it should be a responsibility of the Commission. (See pages 23-54.)

- The Commission should plan and designate a state-wide Freeway System as a part of the State Highway System.

The Freeway System should include the Interstate System and other major routes which ultimately should be developed to freeway standards. (See pages 28 and 34.)

- The General Assembly should place in the Commission the responsibility for the Interstate System and other major routes in the City of Baltimore.

This will require the allocation of an appropriate share of state highway revenues to the Commission and the placing in the Commission of formal authority for carrying out programs in conformity with overall plans agreed to by the City and the Commission. (See pages 19-20, 29-30 and 34.)

- The Commission should define more clearly the responsibilities, authority and relationships within the organization.

This should be accomplished through development and utilization of Commission-wide administrative manuals covering organization, policies and procedures. (See pages 107-111.)

- The Commission should develop a comprehensive management control reporting system.

This should include reports to management on programs, schedules and budgets to provide effective control of Commission performance. (See pages 90 and 111-113.)

- The Commission should participate to a greater extent in personnel administration within the framework of overall state personnel management.

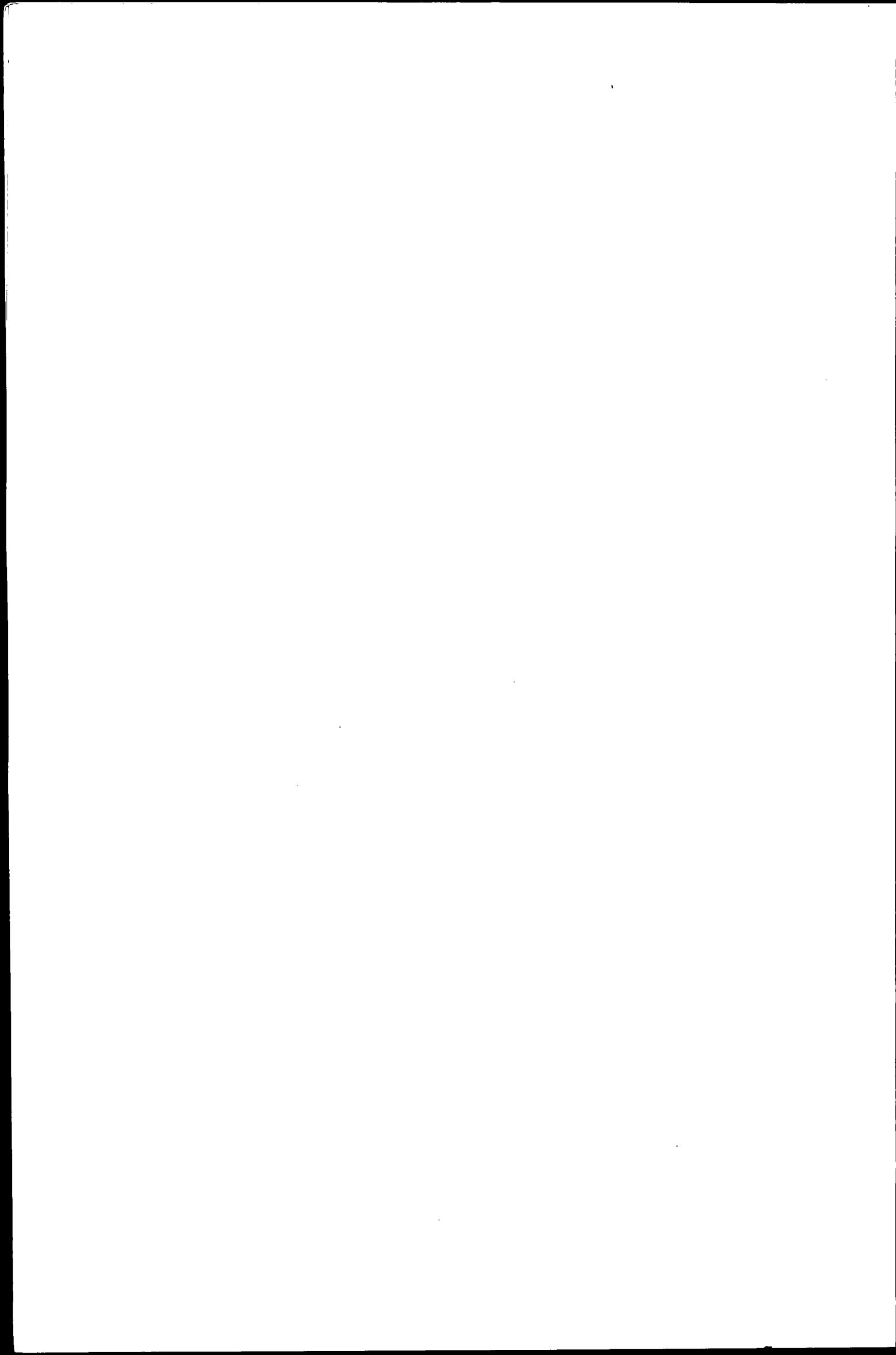
This will require minor amendments in the Merit System Law; studies to determine the relationships that should exist between workloads, manpower complements and staffing patterns; and development of an improved performance appraisal system. (See pages 114-124.)

- The Commission should conduct a thorough research study of the maintenance function.

This should cover detailed analyses of maintenance requirements, operating procedures, staffing patterns and equipment utilization. (See pages 69-78.)

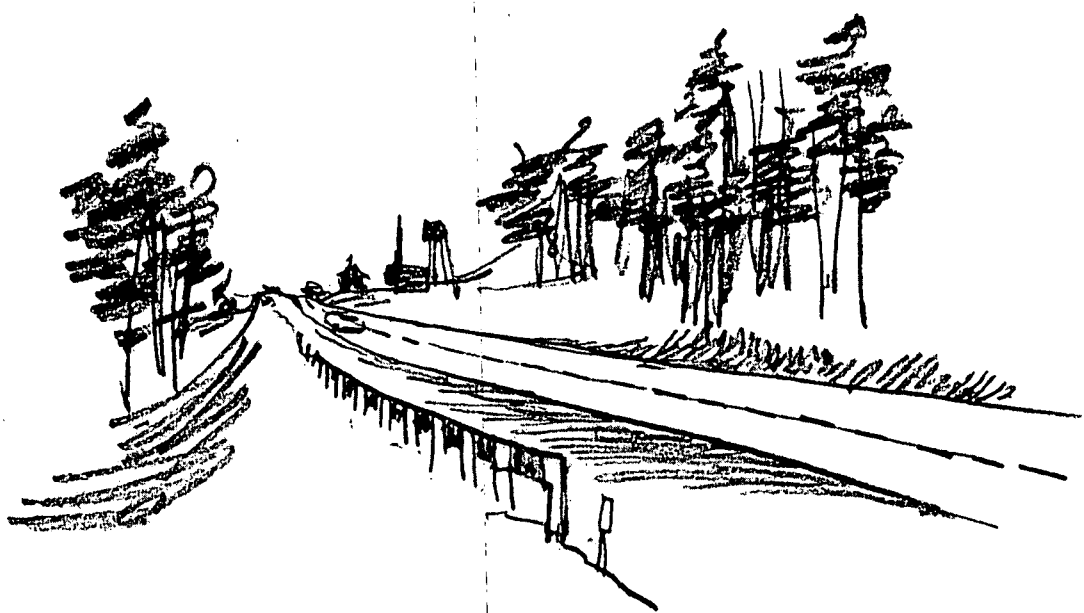
- There should be an expansion of the traffic engineering function in the Commission.

This should include (1) complete surveillance of the State Highway System for traffic improvement measures, (2) continuing accident research, and (3) state-wide uniformity in the application of traffic control measures and devices. (See pages 78-83.)



Part One

GENERAL OBSERVATIONS



Goals and Objectives

It is self-evident that an organization is established to accomplish specific goals and objectives. In creating the State Roads Commission in 1908, the Maryland General Assembly provided that "The said Commission . . . shall have full powers and be charged with the full duties to select, construct, improve, and maintain such a general system of improved State roads and highways, as can reasonably be expected to be completed with the funds herein provided, in and through all the counties of this State." ^{1/}

Although subsequent legislation has further defined, amended or altered the powers and duties of the Commission, the initial enactment remains as a broad statement of the Commission's goals and objectives.

The purpose of this part of the report is to review the Commission's progress — both quantitative and qualitative — in accomplishing the goals and objectives for which it was created. Such accomplishments provide a basis for evaluation of overall Commission performance and reflect the efficiency of the Commission's organizational structure, practices and procedures. They also serve to point out problem areas and significant factors affecting performance, which are discussed in detail in Part Two.

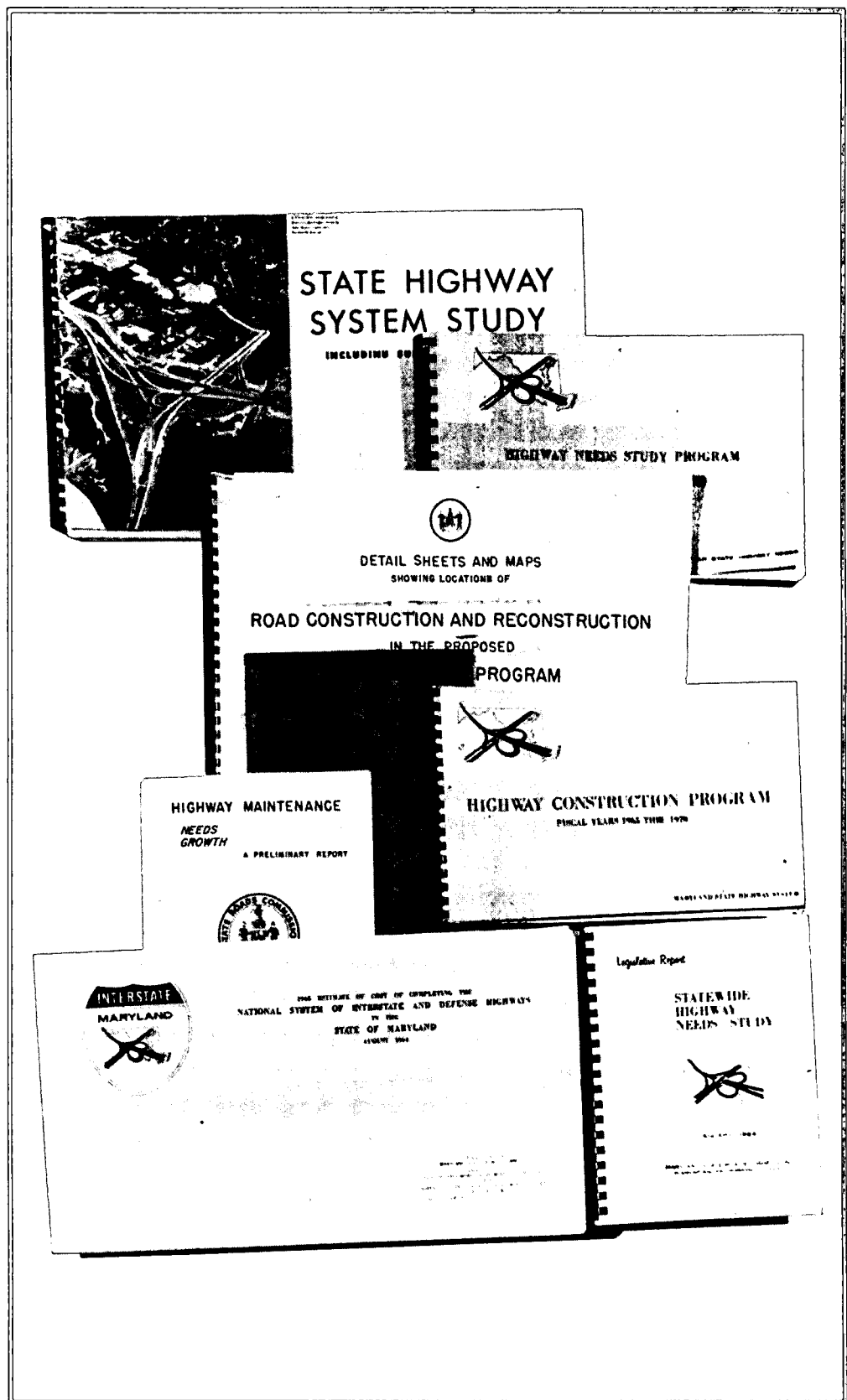
A review of the Commission records and the acts of the General Assembly for the past quarter century reveals a forward-looking and aggressive planning effort on the part of both the Commission and the General Assembly to define specific goals and objectives for Maryland's highway improvement program.

Highlights of this effort include the following:

Year	Planning Effort
1937	The Maryland Primary Bridge Program authorized construction of the Susquehanna, Potomac River and Bay Bridges and the Baltimore Harbor Tunnel.
1947	The Expressway Act ^{2/} provided for controlled-access highways. In addition, a 200-million-dollar highway construction program for the years 1948-1952 was approved. This program was financed by accumulated war-year funds and a 100-million-dollar bond issue.
1948	Highway geometric design standards were adopted.

^{1/} Laws Governing State Roads of Maryland, Article 89B, Section 7, State Roads Commission of Maryland, 1960.

^{2/} Ibid, Section 29.



1952 An inventory and appraisal was made of the entire State Highway System — using the standards adopted in 1948 — and a comprehensive improvement program and a financial plan were developed.

- 1953 A 568.2-million-dollar construction program for the 12-year period 1954-1965 was approved.^{3/} Financing was provided by a one-cent increase in the gas tax and authorization for a 330-million-dollar bond issue.^{4/}
- 1955 The Northeast Expressway was authorized as a toll facility.
- 1956 The Federal Highway Act of 1956, authorizing the National System of Interstate and Defense Highways, was passed.
- 1957 A review study of the State Highway System and the 12-year program, including the effects of the Interstate System, was initiated. Recommendations for program changes after December 31, 1957, were developed.^{5/} In addition, a two-million-dollar revolving fund for advance acquisition of right-of-way was authorized for the five-year period 1957-1962.
- 1960 The 12-year program was altered to a five-year "GO" program to permit concentration of remaining funds on the Interstate and primary systems and to limit secondary system improvements to an annual expenditure of eight million dollars. The requirement to complete 90 per cent of the projects in a given four-year period before proceeding with additional projects was removed. Provisions were made for priority changes and project substitutions on a mileage basis from the original 12-year program as well as from the 1957 review study report. In addition, the Commission was directed to report its recommendations to the 1961 General Assembly regarding secondary road projects.
- 1961 A comprehensive report on the secondary highway system was submitted to the General Assembly.^{6/} This report advocated a 15-year program for the secondary system involving an annual expenditure of 20 million dollars, plus establishment

^{3/} Proposed Twelve-Year Program for Road Construction and Reconstruction 1954-1965, State Roads Commission of Maryland and Advisory Council to the Commission, October 27, 1952.

^{4/} A recommended increase in motor vehicle registration fees did not materialize.

^{5/} State Highway System Study — Including Sufficiency Ratings, State Roads Commission of Maryland, February 1, 1958.

^{6/} The Maryland State Secondary Highway System as of January 1, 1961, Maryland State Roads Commission.

of a 10-million-dollar fund for emergency measures. No formal action was taken by the General Assembly.

- 1962 Senate Joint Resolution No. 13 directed the Commission to undertake a state-wide needs study and submit its report to the 1964 General Assembly.
- 1964 Twenty-year needs were developed on a state-wide basis and reported to the General Assembly^{7/} along with a proposed highway improvement program covering the period 1965-1970.^{8/} The General Assembly approved this program and provided for its financing through a one-cent increase in the gas tax, a ceiling on the distribution of user tax revenues to the motor vehicle and state police departments, a one per cent increase in the titling tax and authorization for a third construction bond issue.

The program was to be prepared as three biennial programs — on an individual county basis — and was to show the month and year when engineering, right-of-way and construction are scheduled to start. Counties were accorded the right of substitution as to project and project priority on a cost basis from the six-year program and the 20-year needs study program. Upon review and approval by the counties, the Commission was directed to adhere to the programs and schedules developed.

These planning efforts are significant in that they indicate the apparent intent of the Commission and the General Assembly to:

- Provide Maryland with a good highway transportation system based on ascertained needs — with periodic updating of needs estimates.
- Establish program goals and objectives as a framework for accomplishment within specified time limits and in accordance with geometric design standards.
- Ensure that local interests are reflected in the development of state highway improvement programs.

^{7/} Highway Needs Study Program, Maryland State Roads Commission, February 1, 1964.

Legislative Report — Statewide Highway Needs Study, Maryland State Roads Commission, January 1964.

^{8/} Highway Construction Program — Fiscal Years 1965 through 1970, Maryland State Roads Commission, Revised February 28, 1964.

- Preserve and protect initial capital investments in major highways through control of access.
- Provide financial means for accomplishment of approved programs.

Accomplishments

In the evaluation of the overall performance of the State Roads Commission in terms of established program goals and objectives, a number of significant facts relevant to accomplishments were observed. These are outlined in the sections which follow.

The primary bridge program — authorized in 1937 — was completed with the opening of the Baltimore Harbor Tunnel in 1957. The Susquehanna and Potomac River Bridges were completed in 1940 and the Bay Bridge was opened to traffic in 1952. These were major accomplishments. No specific time limit had been set for completion of this program.

CONSTRUCTION

The five-year program (1948-1952) — authorized in 1947 — was to provide Maryland with a "system of highways second to none in the nation". ^{9/} During the first four years of the program, 757 miles of highways were constructed or reconstructed at a cost of 106.3 million dollars. The program was not completed within the original time limit and some improvements remained to be accomplished when funds were exhausted in 1953.

The 12-year program (1954-1965) — authorized in 1953 — called for construction, reconstruction or rehabilitation of 3,452 miles of state highways at an estimated cost of 568.2 million dollars. ^{10/} This was an ambitious program and comprised the basic plan for improvement of the State Highway System until the "GO" program modification was approved in 1960, authorizing substitutions and priority changes.

1. At the end of the first four years, 60 per cent of the mileage programmed for that period had been placed under contract and over 90 per cent of the funds authorized for that period had been expended.

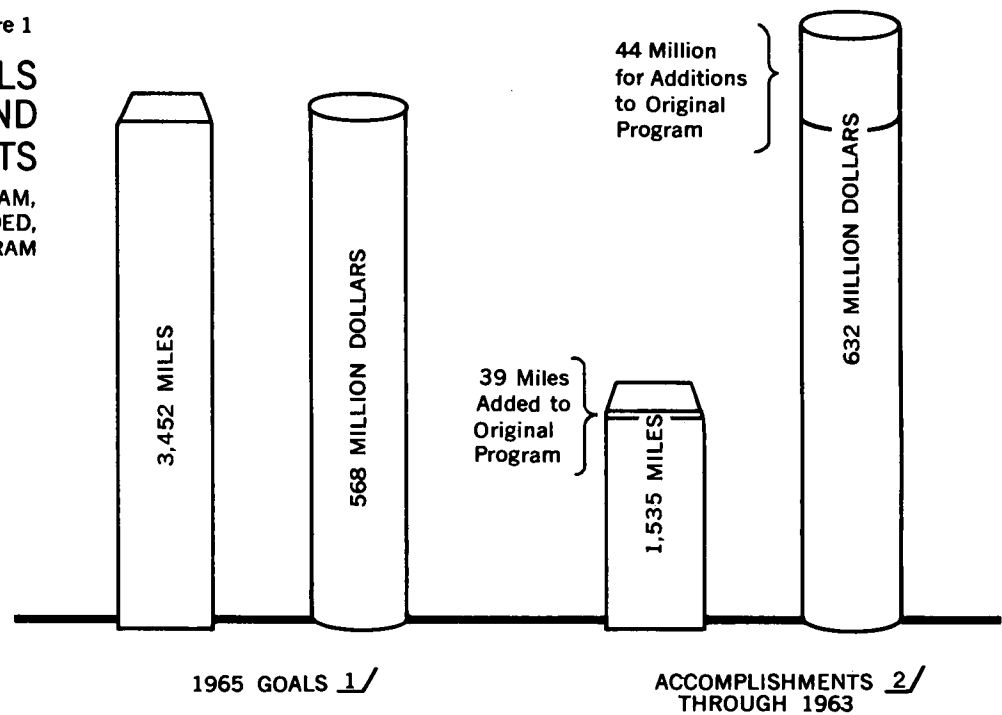
^{9/} A History of Road Building in Maryland, State Roads Commission of Maryland, 1958, page 157.

^{10/} Based on 1947-1952 average cost experience.

2. By 1960, less than 90 per cent of the first four years of work had been advertised, and actual costs had exceeded program estimates by nearly 56 per cent.
3. By December 31, 1963, 1,535 miles of construction projects had been authorized — about 45 per cent of the original program mileage (see Figure 1). Authorized expenditures for this amount of construction totaled 632 million dollars.^{11/}

Figure 1

**CONSTRUCTION GOALS
AND
ACCOMPLISHMENTS**
FOR THE 12-YEAR PROGRAM,
AS AMENDED,
AND THE INTERSTATE PROGRAM



^{1/} Established in 1953 by the 12-year program.

^{2/} As measured by authorization for construction projects.

Data: State Roads Commission report as of December 31, 1963.

4. With reference to Figure 1, 588 million dollars of the 632 million dollars authorized were for projects listed in the original 12-year program and 44 million dollars were authorized for the program amendments provided by subsequent legislation.
5. Costs materially exceeded estimates for projects on all highway systems (see Figure 2). However, the increase was noticeably less on the State Primary System.

^{11/} It should be recognized that many of the projects completed during this period represented the more expensive, high-standard type of improvements — such as the Baltimore and Capital Beltways. An additional 29 million dollars also was authorized at this time for future construction projects in the 12-year program.

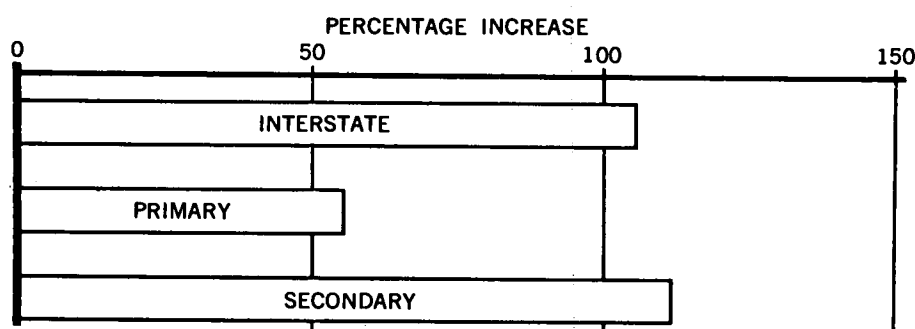


Figure 2

COSTS OF 12-YEAR PROGRAM PROJECTS

AS RELATED TO ORIGINAL PROJECT ESTIMATES

Note: Costs are based on authorized expenditures.

Data: State Roads Commission report as of December 31, 1963.

The six-year program (1965-1970) — authorized in 1964 — calls for improvements on 890 miles of state highways at an estimated cost of 422.5 million dollars. This program is being developed as three biennial programs; i.e., fiscal 1965-66, 1967-68, 1969-70. The 1965-66 biennial program has been developed and adopted by the Commission. There are indications that costs will exceed original program estimates and that many of the projects may not be completed by the approved schedule dates. For example:

1. Revised right-of-way acquisition cost estimates are running roughly 85 per cent higher than original estimates.
2. Revised time estimates for clearance of right-of-way are averaging six months later than original estimates in 52 of 65 projects requiring land acquisition.^{12/}

The above data reveal certain significant facts relative to accomplishment of the Commission's construction programs. These are:

- A major bridge program has been completed.
- Approximately 2,300 miles of highways were constructed or reconstructed during the period 1948-1963.
- Established programs have not been completed within specified time or cost limits.

The Commission has not defined goals and programs for physical maintenance of the State Highway System to the same degree that it has for construction. The level of maintenance achieved has been largely determined by funds made available rather than through programs based on analysis of maintenance needs. Although there are no well-defined

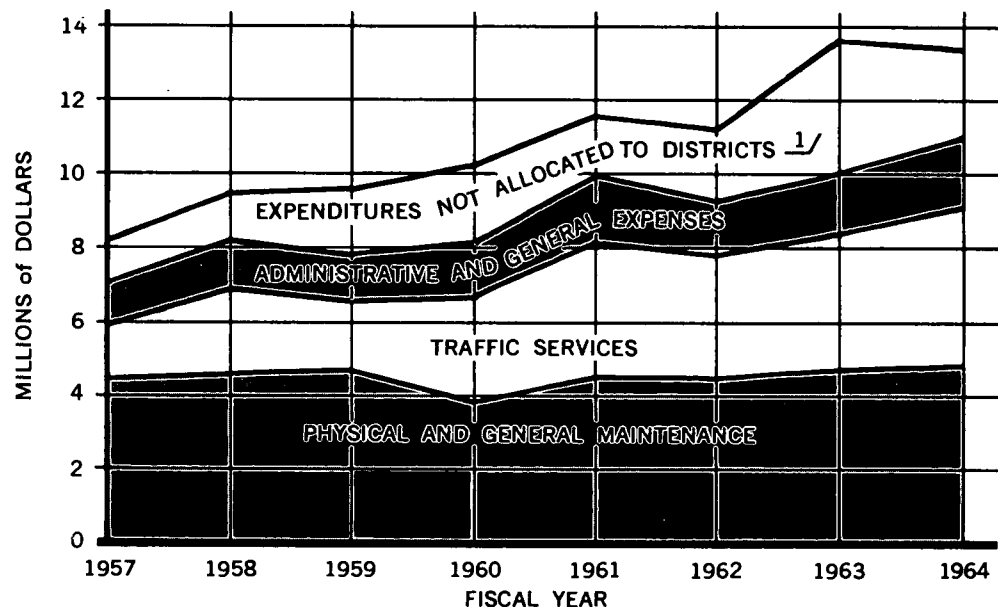
MAINTENANCE

^{12/} Based on estimates of the Right-of-Way Division.

maintenance programs, trends in the size and distribution of maintenance expenditures, in combination with other data, do provide some basis for evaluation.

The data in Figure 3 indicate that total maintenance expenditures have been increasing. Sharp increases were experienced in expenditures for traffic services and those expenditures not allocated to the districts, while expenditures for physical and general maintenance have remained relatively stable. Administrative and general expenses have increased proportionately with total maintenance expenditures.

Figure 3
STATE
MAINTENANCE
FUND
EXPENDITURES



^{1/} Major portion of this is for capital investment in land, buildings and equipment.

Data: Biennial reports, State Roads Commission.

Even though actual physical and general maintenance expenditures have been slowly increasing, the data in Table 1 show that these expenditures have been decreasing in terms of expenditures per square yards of pavement. However, a 1962 state-wide maintenance study indicated the need for substantial additional expenditures for physical and general maintenance.^{13/}

Figures 4 and 5 show the rate of growth in physical and general maintenance and traffic service costs between 1956 and 1962 for state highways in Maryland and for the United States. The data indicate that Maryland's increase in expenditures in these two categories is roughly comparable to the national trend.

^{13/} A Preliminary Report — Highway Maintenance in Maryland, State Roads Commission of Maryland (1963), page 14.

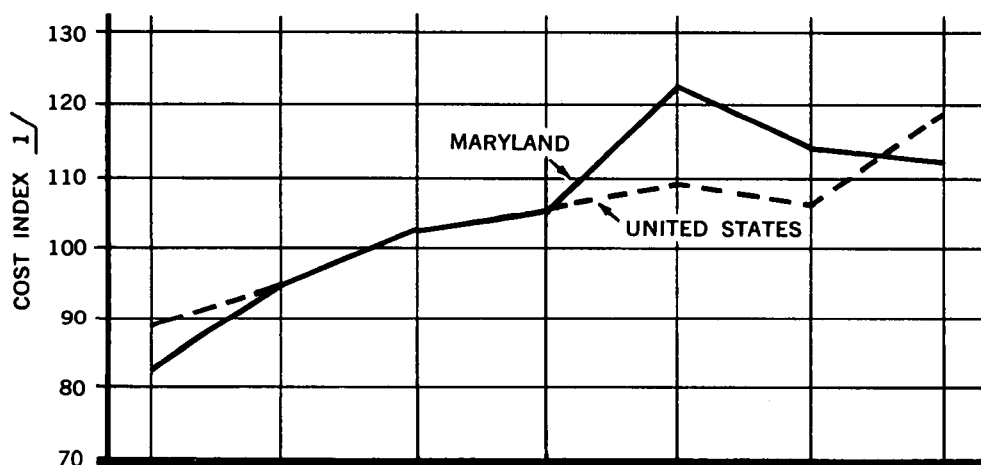
Fiscal Year	Total Expenditures		Expenditures Per 10,000 Square Yards	
	Per Linear Mile	Per 10,000 Square Yards of Surface	For Physical and General Maintenance	For Traffic Services
1957	\$1,739	\$1,509	\$717	\$278
1958	2,037	1,531	715	415
1959	2,083	1,541	744	310
1960	2,153	1,500	573	420
1961	2,467	1,689	639	525
1962	2,369	1,589	627	467
1963	2,831	1,887	642	523
1964	2,795	1,815	645	580
1965	2,859 (budgeted)			

Table 1

STATE
MAINTENANCE
FUND
EXPENDITURES

PER UNIT OF MEASUREMENT

Data: Planning and Programming Division and biennial reports, State Roads Cammission.



PHYSICAL AND
GENERAL MAINTENANCE

Figure 4

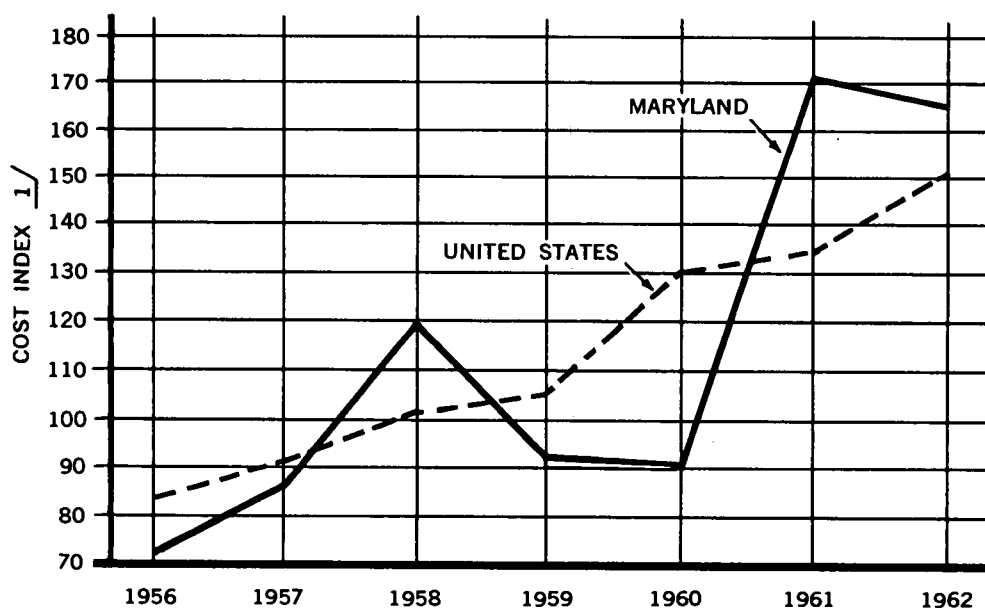


Figure 5

TRAFFIC SERVICES

1/ Base years 1957-1959.

Data: Highway Statistics, U.S. Bureau of Public Roads.

Table 2 contains data which indicate relationships between expenditures (out of the State Maintenance Fund) for salaries and wages, contractual payments and total general and administrative expenditures — developed to provide some basis for evaluation of performance of the maintenance function.

Analysis of these data reveals that there has been a steady decrease in expenditures for salaries, wages and benefits in relation to total expenditures since 1957. One indication of the significance of the decrease is that of every dollar spent for maintenance in 1964, nine cents less were required for personnel payments than in 1957.

The data relative to contractual payments for oiling and other purposes do not show a steady trend — such payments being almost equal (percentage-wise) for the periods 1957-1960 and 1961-1964. This would indicate that the overall improvement in utilization of personnel is not being offset to any great extent by contractual services. However, there has been some proportional increase in general and administrative expenditures —reaching a high point in 1961 but trending lower since then.

In summary, the increased maintenance expenditures do not appear to be excessive when compared to the national average. There may be a need for greater expenditures for physical and general maintenance — as evidenced by the state-wide maintenance study. However, efficiency of performance of the maintenance function cannot adequately be evaluated due to lack of valid measures of performance. Current research in maintenance indicates there is a need for maintenance performance standards in most state highway departments.

PERSONNEL

Table 3 contains data relative to the Commission's total expenditures for salaries, wages, benefits and payments for contractual professional and technical services during the period 1957-1964. These data indicate the following:

1. The total number of employees increased from 3,012 to 3,681 — or 22.2 per cent. The number of salaried employees increased 38.2 per cent and the number of personnel on wages decreased 6.2 per cent.
2. There was a steady decrease in the number of employees per million dollars expended — from 32.1 in 1957 to 26.2 in 1964. To the extent that accomplishments of the Commission may be measured by expenditures, it can be said that the amount of each dollar devoted to salaries, wages and benefits decreased by 5.9 cents.

1	2	3	4	5	6	7	8	9	10
Fiscal Year	Total Expenditures (1,000)	Salaries, Wages and Employee Benefits (1,000)	% Col. 2	Administrative and General Expenses (1,000)	% Col. 2	Contractual Payments — Oiling (1,000)	% Col. 2	Contractual Payments — Construction (1,000)	% Col. 2
1957	\$ 8,179	\$3,465	42.4	\$1,074	13.1	\$179	2.2	\$155	1.9
1958	9,627	3,834	39.8	1,282	13.3	98	1.0	192	2.0
1959	9,719	3,700	38.0	1,332	13.7	206	2.1	455	4.6
1960	10,168	3,838	37.7	1,495	14.7	181	1.8	334	3.3
1961	11,776	4,175	35.5	1,946	16.5	225	1.9	281	2.4
1962	11,402	4,107	36.0	1,672	14.6	295	2.6	156	1.4
1963	13,676	4,348	31.8	1,800	13.2	110	0.8	505	3.7
1964	13,631	4,534	33.3	1,887	13.8	332	2.4	514	3.8

Data: Biennial reports, State Roads Commission.

Table 2

MAINTENANCE EXPENDITURES FOR
SALARIES, WAGES, ADMINISTRATION AND
CONTRACTUAL SERVICES
STATE MAINTENANCE FUND

Table 3
PERSONNEL-EXPENDITURE
RELATIONSHIPS

1 Fiscal Year	2 Total Expenditures (1,000)	3 Persons Employed		5 Wages and Salaries		7 Contractual Services <u>1/</u>		9 Total Personnel Services		11 Number Contract <u>2/</u> Employees	12 District Personnel	
		Total	Per Million \$ Expended	(1,000)	% Col. 2	(1,000)	% Col. 2	(1,000)	% Col. 2		Number	% Col. 3
1957	\$ 93,894	3,012	32.1	\$12,935	13.7	\$3,299	3.5	\$16,234	17.3	1	1,795	59.6
1958	104,382	3,152	30.2	14,495	13.9	3,405	3.3	17,900	17.1	1	1,780	56.5
1959	122,967	3,278	26.7	15,727	12.8	4,870	4.0	20,597	16.8	10	1,767	53.9
1960	113,622	3,279	28.9	16,472	14.5	2,818	2.5	19,290	17.0	16	1,749	53.3
1961	120,505	3,386	28.1	18,161	15.1	2,377	2.0	20,538	17.0	19	1,762	52.0
1962	137,147	3,464	25.3	17,873	13.0	3,076	2.2	20,949	15.3	24	1,799	51.9
1963	131,471	3,591	27.3	19,090	14.5	2,255	2.2	21,335	16.2	16	1,834	51.1
1964	140,395	3,681	26.2	20,929	14.9	2,887	2.0	23,816	17.0	17	1,752	47.5

1/Columns 7 and 8 are for contractual professional and technical services.

2/Column 11 refers to contract employees within the Commission.

Data: Biennial reports and personnel records, State Roads Commission.

3. Expenditures for contractual professional and technical services to augment the personnel forces of the Commission decreased in relation to total expenditures — from 3.5 per cent in 1957 to 2.0 per cent in 1964.
4. Combined expenditures for salaries, wages, benefits and payments for contractual professional and technical services remained fairly stable in relation to total expenditures — although they ranged from 15.3 per cent to 17.3 per cent.
5. While the actual number of personnel assigned to districts remained relatively stable, the proportion of the total employee force assigned to districts decreased steadily — from 59.6 per cent in 1957 to 47.5 per cent in 1964.
6. A relatively small number of persons are regularly employed on a contractual basis in organizational units of the Commission. There were 17 in 1964.

Since the Commission is spending a gradually decreasing proportional amount for outside professional and technical services and is obtaining greater productivity (dollar-wise) per employee, it is improving its position in this important area of personnel administration.

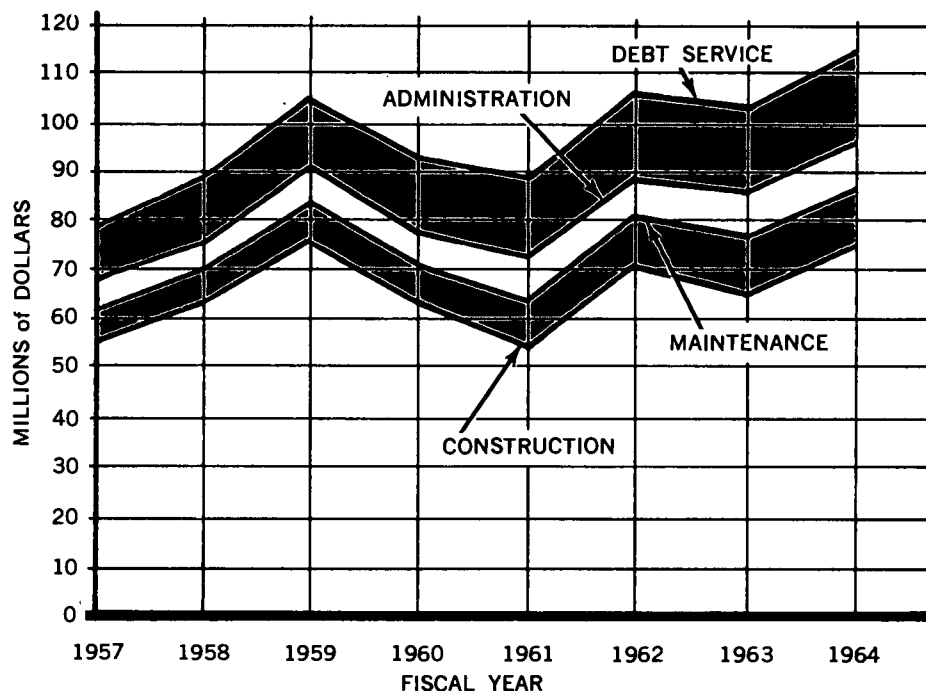
Figures 6 and 7 show historical trends and relationships in major expenditures on state highways — excluding toll facilities — for construction, maintenance, debt service, and associated administrative and general expenses for the years 1957-1964. These data indicate the following:

MAJOR EXPENDITURE TRENDS

- There has been a general upward trend in all major expenditures.
- There has been a slight upward trend in the rate of expenditures for maintenance, debt service, and administrative and general expenses in relation to total expenditures.
- There has been a general downward trend in the rate of construction expenditures in relation to total expenditures.

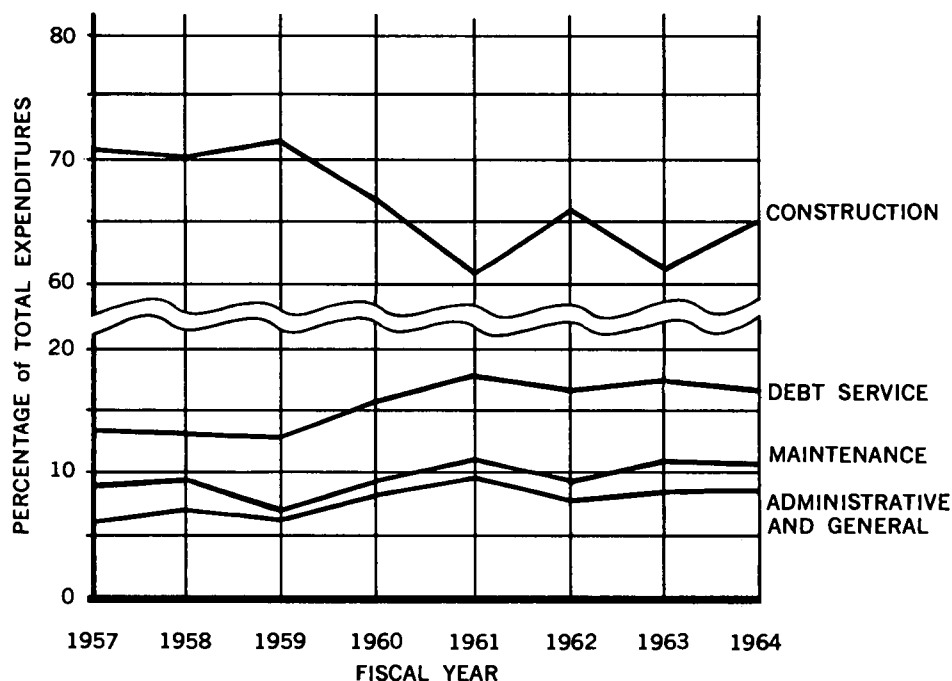
The major significance of these data is that although construction expenditures have steadily increased from 55.8 million dollars in 1957 to 75.1 million dollars in 1964 — an overall increase of 35 per cent — a smaller proportion of each dollar spent has been for construction.

Figure 6
TRENDS OF
MAJOR
EXPENDITURES
STATE HIGHWAY SYSTEM
(excluding toll facilities)



Data: Biennial reports, State Roads Commission.

Figure 7
TRENDS IN
RELATIONSHIPS
BETWEEN MAJOR
EXPENDITURES
STATE HIGHWAY SYSTEM
(excluding toll facilities)



Data: Biennial reports, State Roads Commission.

A review of major expenditures in the past eight years reveals that administrative and general expenses experienced the greatest rate of increase — from 5.3 million dollars in 1957 to 9.7 million dollars in 1964, an overall increase of 84 per cent.

A comparison of trends in Maryland's state highway administrative and miscellaneous costs with those for the entire United States — between 1958 and 1962 — is shown in Figure 8. The data indicate that there was a general upward trend but that the rate of increase in Maryland was greater than for the nation as a whole.

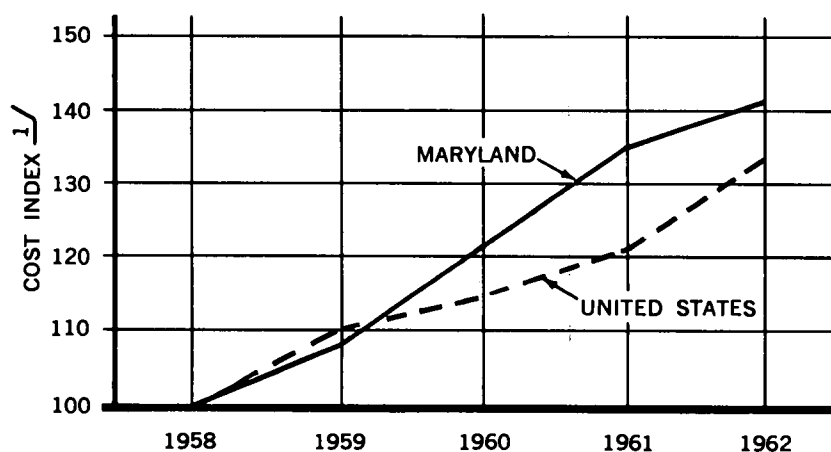


Figure 8

TRENDS IN ADMINISTRATIVE AND MISCELLANEOUS COSTS

STATE-ADMINISTERED HIGHWAYS

(excluding toll facilities)

^{1/} Base year 1958.

Data: Highway Statistics, U. S. Bureau of Public Roads.

The U. S. Bureau of Public Roads uses federal-aid obligations in relation to fiscal year apportionments as one measure of progress in the federal-aid program.

Table 4 shows the percentage of fiscal year apportionments obligated by states for Interstate and primary, secondary and urban federal-aid programs as of June 30, 1964. The data indicate that Maryland

FEDERAL-AID OBLIGATIONS

Program	Percentage of Fiscal Year Apportionment Obligated					
	1965 Funds		1964 Funds		1963 Funds	
	50-100	1-49	50-100	1-49	50-100	1-49
	Number of States		Number of States		Number of States	
Interstate	22	11	11	3	1	1
ABC ^{1/}	22	17	7	3	-	1
				(including Maryland)	(Maryland)	

Table 4

STATUS OF FEDERAL-AID OBLIGATIONS

As of June 30, 1964

^{1/} Federal-aid primary, secondary and urban.

Data: "Progress of Federal-aid Highway Program," U. S. Bureau of Public Roads.

ranked 48th in the nation for all programs, lagging the nationwide average obligation time by about 1-1/2 years. Maryland had 99 million dollars in Interstate funds and 18 million dollars in other federal-aid funds available for obligation on June 30, 1964.

Interstate funds available for obligation by the Commission amounted to about 40 million dollars — less than one year's apportionment. The remaining 59 million dollars have been allocated to the City of Baltimore for its portion of the Interstate System. With 1964 being the mid-year of the total Interstate program, the Commission has obligated about half its program needs; Baltimore about 10 per cent.

The significance of these data is that — on the basis of Interstate fund obligations — the Commission is about on schedule and Baltimore will have to increase its obligation rate eightfold if it is to complete its share of the program by 1972.

As of June 30, 1964, the Commission had slightly over four million dollars in federal-aid primary funds — just under one year's apportionment — available for obligation. This placed the Commission about four months behind the nationwide average.

Present Commission policy is to grant county and municipal governments first choice to obligate federal-aid secondary and urban funds. If such funds are not obligated within three years, however, they are no longer available to the State. Consequently, such funds that are not used by local governments within two years are obligated by the Commission for state highway projects. This policy accounts for a major part of the lag in obligation of secondary and urban funds.^{14/}

The foregoing factors indicate that:

- Maryland ranks at or near the bottom among the states in the obligation of federal-aid apportionments.
- Maryland's low rank primarily is attributable to the status of Interstate obligations in the City of Baltimore and secondary and urban fund obligations by local governments.
- Fund obligations on state-administered highways are comparable to the nationwide average.
- The status of Interstate fund obligations in Baltimore indicates the need for a greatly accelerated program if Maryland's Interstate System is to be completed by 1972.

SAFETY

Safer travel on Maryland's highways is a major objective of the Commission. Wider surfaces, median dividers, control of access and other engineered features contribute to traffic safety and provide greater service and comfort.

The data in Figure 9 indicate that between 1956 and 1963 the number of miles on the State Highway System under 20 feet in width decreased by 600 miles and divided highway mileage, including routes

^{14/}The Commission has approved a state-aid plan, subject to concurrence by the U. S. Bureau of Public Roads and the local governments in the State. If effected, this plan will materially improve the State's position with regard to obligation of secondary funds.

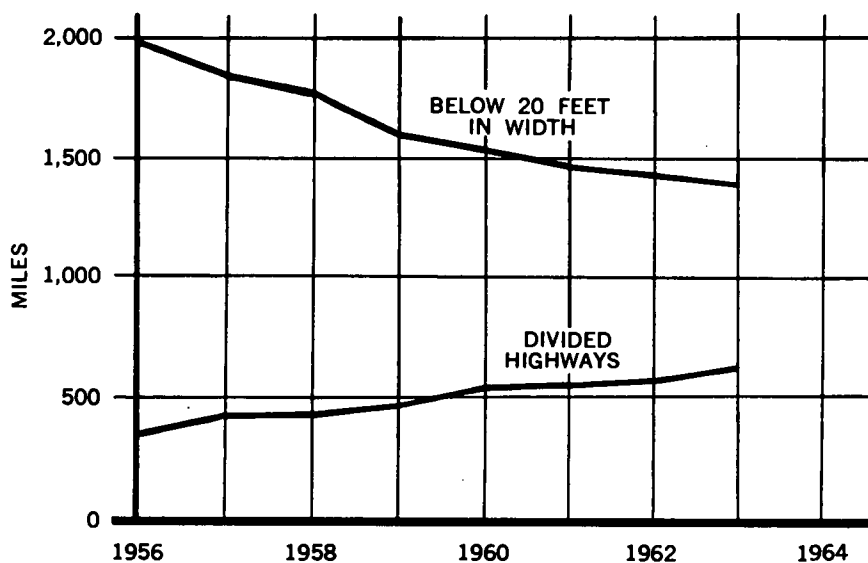


Figure 9

TREND IN HIGHER TYPE FACILITIES

STATE HIGHWAY SYSTEM

Data: State Roads Commission and Highway Statistics, U. S. Bureau of Public Roads.

with access control, increased by 83 per cent — to a total of 688 miles. At the same time, undivided highway mileage with a surface width of 24 feet or more increased 430 miles.

Although highway safety also is dependent on such factors as education, enforcement, and road maintenance and operation, trends in accident and fatality rates can be attributed in part to improvements in the highway system.

Between 1956 and 1963, the accident rate on the State Highway System decreased by 30 per cent — from 314 to 221 accidents per 100 million vehicle-miles of travel. In the same period, the fatality rate decreased by 35 per cent — from 6.3 to 4.1 fatalities per 100 million vehicle-miles.

The data in Figure 10 show that — on all highways, roads and streets in the State — the fatality rate decreased 21 per cent — from

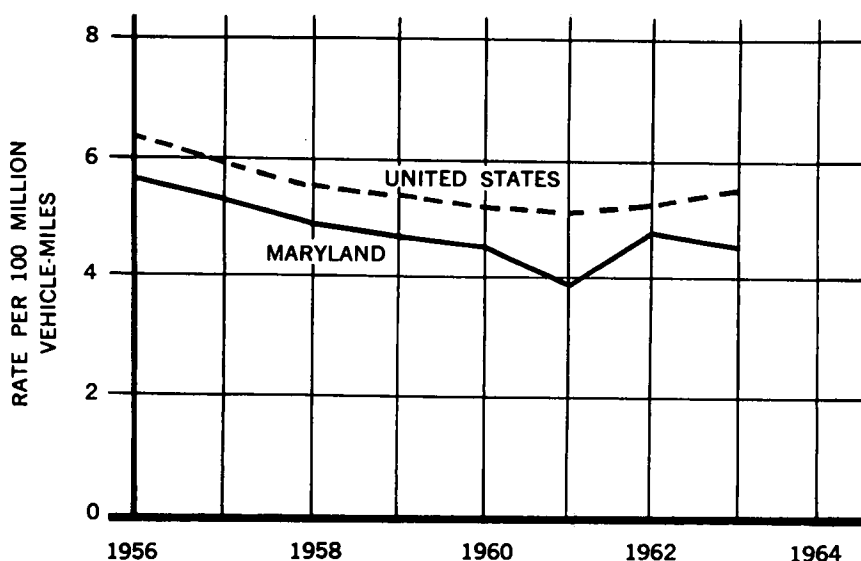


Figure 10

TREND OF FATALITY RATES

ALL HIGHWAYS, ROADS AND STREETS

Data: Accident Facts, National Safety Council.

5.7 to 4.5 fatalities per 100 million vehicle-miles. At the same time, the nationwide average fatality rate decreased by only 14 per cent — from 6.4 to 5.5 fatalities per 100 million vehicle-miles.

Thus, in terms of its traffic safety objective, these data indicate that the Commission has made notable progress.

Summary

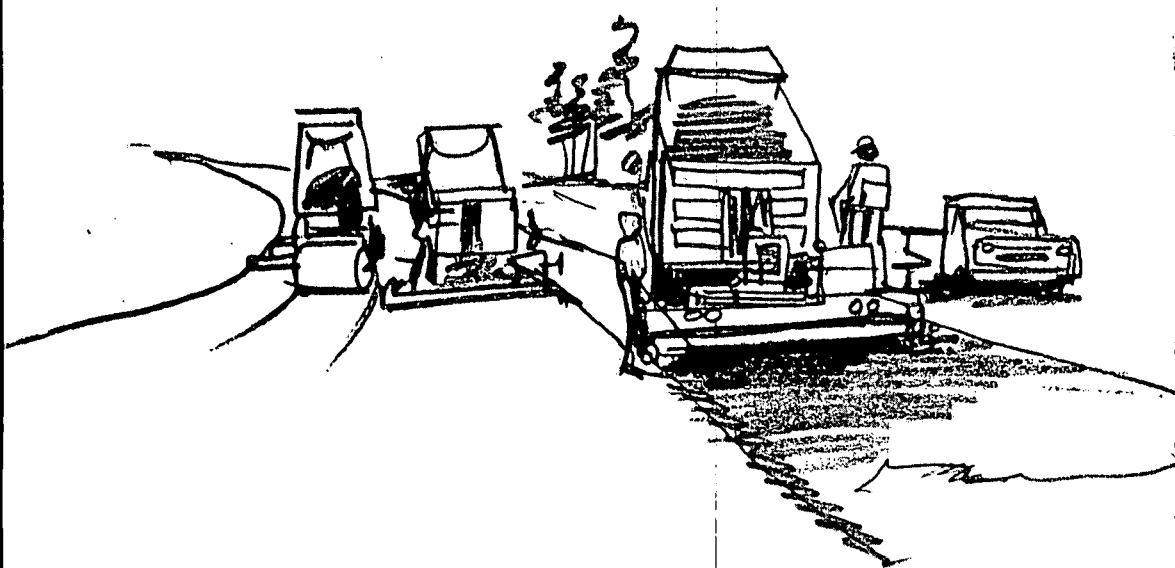
The preceding observations reveal a number of significant facts relative to management and operations of the State Roads Commission. These are:

1. During the past 14 years, there have been significant accomplishments by the Commission — more highways with access control, wider roads and increased traffic safety. Even so, the Commission did not fully accomplish the goals which it originally established in its programs — for a number of reasons which are discussed in detail in Part Two of this report.
2. There are indications that physical and general highway maintenance needs are increasing — yet expenditures for these needs have been steadily decreasing on a surface unit basis and in proportion to total maintenance expenditures. At the same time, expenditures for traffic services have increased rather sharply.
3. The number of Commission employees has been increasing, but a smaller amount of each dollar expended now is devoted to personnel and outside contractual services.
4. Although overall major expenditures have been increasing, a smaller amount of each dollar expended now is devoted to highway construction.
5. Maryland's position in the obligation of federal-aid apportionments is extremely poor in relation to other states. However, this situation primarily can be attributed to the status of the Interstate program in the City of Baltimore and to fund obligation practices with regard to county and municipal jurisdictions.

These broad-gauge measures of overall performance — along with a more detailed evaluation of the Commission organization, operations and practices — reveal many commendable aspects of highway management in Maryland. On the other hand, investigation and analysis revealed that major problems — and opportunities for significant improvement and accomplishment — do exist. All these areas, and specific findings related to performance, are discussed in Part Two.

Part Two

FINDINGS AND RECOMMENDATIONS



Highway Planning

In a broad sense, highway planning may be defined as the performance and coordination of all the development processes necessary to:

1. Formulate a plan for overall development of the state highway network based on predicted population characteristics, land developments and traffic service requirements.
2. Establish a program of priority improvements — a stage in the overall development plan — that provides the working basis for the immediate future in accord with funds available.
3. Set up a practical schedule for accomplishment of each activity on each project in the current program so that — by adhering to the activity schedules — every project will be completed in its proper order, and the whole program will be completed on time.

There are three distinctive processes involved — long-range planning, programming and scheduling. Although all have to be closely coordinated, each has specific requirements. Accordingly, in this report the planning activities presently conducted by the State Roads Commission are evaluated under each process and the organization for planning — the coordination of these processes — is treated separately.

Basic to the development of the State Highway System is a definition of the objective — the establishment of a long-range plan for development.

LONG-RANGE PLANNING

The plan must be based on an evaluation of the existing and future needs for transportation. It requires appropriate standards for evaluation of needs and for planning of construction projects. There must be projections of growth patterns, coordination with local governments and integration of the highway plan with other types of community development.

Quite obviously, a long-range plan must be continuously updated to take account of changed conditions and changing needs and it must be summarized in cost figures so the adequacy of existing financial provisions can be appraised.

Most important, such a plan requires a delicate balance between firmness and flexibility. It must be firm enough to provide realistic projections of requirements to guide the highway improvement program with sureness as to character, location and cost of needed construction. But, it must be flexible enough to adjust to changed conditions as the program moves forward.

Long-range highway planning in Maryland during the past 15 years has been accomplished primarily through three "needs" studies, as follows:

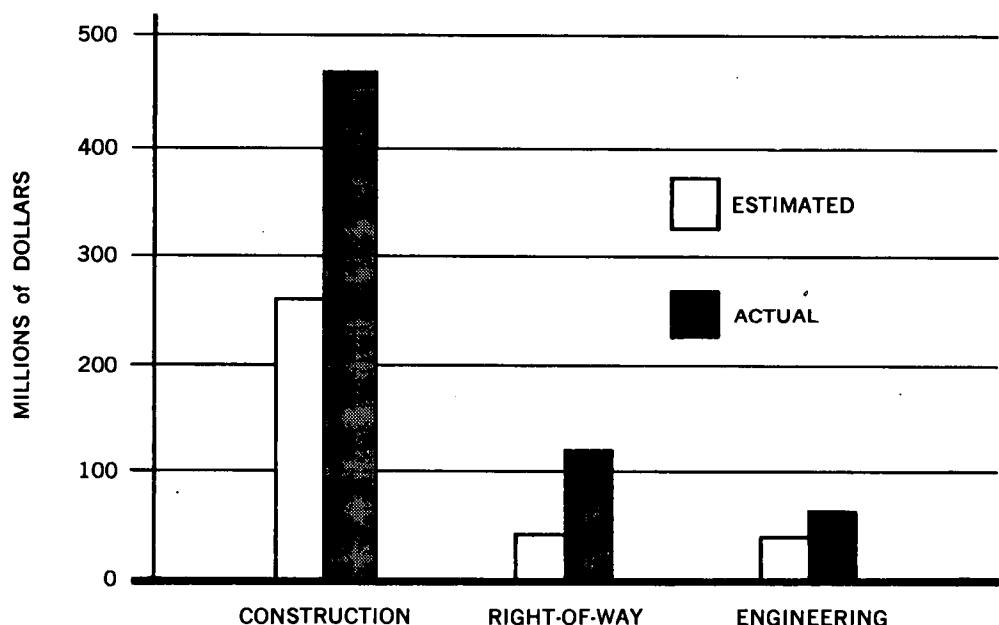
1. A mile-by-mile inventory and appraisal of the total road system — in 1951-52. This study provided the basis for the 12-year program adopted in 1954.
2. A 1958 systems study — to update the 1951-52 study and take account of the effects of the Interstate program. This study provided the basis for the "GO" program adopted in 1960 — a modification of the 12-year program.
3. A 1964 state-wide needs study — which provided the basis for the 1965-1970 program adopted in 1964.

Neither the 12-year program nor the "GO" program was accomplished within anticipated costs or time. The major reasons for the failure to accomplish these official objectives were rising costs — occasioned in large part by changes in standards — plus increasing land values and greater than anticipated traffic growth.

COSTS

The original cost estimates of the 12-year program were based on average costs for the 1947-1952 period. The data in Figure 11 compare estimated and actual costs associated with that portion of the 12-year program for which authorizations have been made. These comparisons indicate that (1) actual construction costs exceeded estimates by over 200 million dollars, (2) right-of-way expenditures exceeded estimates

Figure 11
ESTIMATED AND
ACTUAL COSTS OF
THE 12-YEAR
PROGRAM ^{1/}
ALL PROJECTS AUTHORIZED
AS OF DECEMBER 31, 1963



^{1/} Administrative costs have been pro-rated to construction, right-of-way and engineering.
Data: State Roads Commission report as of December 31, 1963.

by more than 80 million dollars, and (3) expenditures for engineering exceeded estimates by 20 million dollars. In total, actual expenditures exceeded estimates by some 310 million dollars, or almost 90 per cent — a very significant difference.^{15/}

Figure 12 contains data which compare projected traffic growth — on which original cost estimates of the 12-year program were based — and actual growth which affected actual costs. The data indicate that state-wide traffic growth estimates were quite accurate for the period to 1960 — at which time actual growth began to exceed projected growth. However, there was considerable variance between actual and projected growth in rapidly developing areas of the State.

TRAFFIC GROWTH

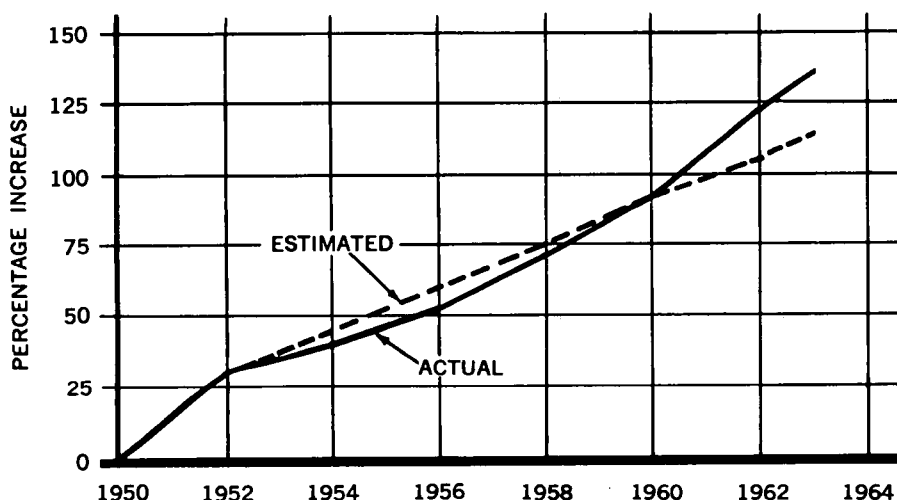


Figure 12

COMPARISON OF TRAFFIC GROWTH WITH TRAFFIC FORECASTS

STATE-MAINTAINED ROADS
(excluding toll facilities)

Data: Planning and Programming Division; Proposed Twelve-Year Program for Road Construction and Reconstruction 1954-1965, State Roads Commission.

For example, traffic on the third section of Interstate Route 695 (Baltimore Beltway) was projected (in 1952) to reach an average daily traffic (ADT) volume of approximately 16,500 by 1965, yet in 1963 actual volumes ranged from 28,700 to 45,800 ADT on different portions of this section. Maryland Route 586 was projected to reach 10,540 ADT by 1965, but in 1963 actual volumes ranged from 27,250 to 36,500. Original estimates for the Capital Beltway indicated that four lanes would be sufficient, but subsequent estimates dictated that six lanes be constructed.

^{15/} These data include allocation of administrative costs.

STANDARDS

Since adoption of the 12-year program as the official objective of the Commission, the standards used for design and construction have been subject to progressive change. Concepts for design of controlled-access highways were influenced by inauguration of the Interstate System. This included increased vertical clearances for structures, lengthened acceleration and deceleration lanes, higher type shoulders and surfaces, and increased requirements for signing and illumination. During the same period, standards were rising for highways other than controlled-access facilities — influenced by demands for greater speeds and safety.

Moreover, there are indications that projects in the 1965-66 program do not follow the same standards contemplated in the needs study. ^{16/}

It is noteworthy that the Commission does not have a firm policy regarding the extent to which the State Highway System will be developed with controlled access, nor does it have definitive official standards that are consistently applied in the development of projects from long-range planning through design and construction.

SUMMARY

The net effect of rising standards and increased traffic growth — together with rapidly rising land prices — was to make it a foregone conclusion that the 12-year program could not be completed within original cost or time estimates. One thing lacking — from a management standpoint — was a process which provided a continuous evaluation of factors affecting needs, costs and progress, as well as a determination of the effects of these factors on the program.

Although annual reports of the Commission included pertinent financial information relative to the construction program, the first formal report to the General Assembly of lagging progress due to the effects of increasing costs and changing conditions was made in connection with the 1958 state highway systems study — four years after

^{16/} An example is Maryland Route 165 in Harford County which calls for a 20-foot pavement. The projected ADT for 1982 is 3,300. The standards in the 20-year study called for a 24-foot pavement. Another example is Maryland Route 312 in Caroline County between Ridgely and Bridgetown. The two-year program calls for rehabilitation, with no money set aside for right-of-way acquisition, even though the present right-of-way is only 40 feet wide. It presently is proposed to construct a 22-foot pavement with eight-foot shoulders within a 60-foot right-of-way. However, with a projected volume of 1,100 ADT, the needs study standards call for a 24-foot pavement with 10-foot shoulders and a 100-foot right-of-way.

the 12-year program was undertaken and six years after completion of the needs study on which the program was based.

There are indications that a similar situation may develop with regard to the cost estimates in the 20-year needs report (1964), which is the basis for the 1965-1970 program. Revised estimates for acquisition of right-of-way for projects in the first two-year program now exceed original estimates by 85 per cent. In addition, comprehensive transportation studies have not been completed for all major developed areas of the State. When such studies are completed, it is likely that changes in existing estimates will be required.

Several conclusions can be drawn from the developments over the past 15 years in relation to long-range planning concepts and the planning practices of the Commission.

- There is a need to have the long-range planning function clearly defined, with responsibility placed for carrying out the function on a continuing basis.

The needs studies in the past have been carried out by task forces — created to do the job and disbanded when the study was done. This lack of continuity in long-range planning is probably the reason why the current program based on the 1964 needs study is likely to have the same basic inadequacies in standards, traffic forecasts and costs as was experienced in the 12-year program.

Planning of any kind, if carried out in an effective manner, requires a follow-up or control process — and a replanning to take account of changing conditions as they occur. The task force approach is not adapted to this, nor to study and research into construction and right-of-way costs, techniques for traffic estimating and forecasting, and other activities which will contribute to better estimating of needs.

Functions and responsibilities that should be assigned to the planning unit to have continuous long-range planning are discussed in a later section dealing with organization for planning.

- There is a need for firm and realistic standards — standards that will be used in developing the long-range plan and will remain firm as individual projects are designed and constructed.

The Commission developed standards for highway improvements in 1948 but these have not been updated to serve currently as the official policy on standards for planning and design. Instead, the practice has been to use the policy guidelines of the American Association of State

Highway Officials, which allow considerable latitude in application and are not sufficiently specific to provide the degree of control needed for planning and designing highways in a state with the variety and character of development that exists in Maryland.

The absence of firm standards has resulted in judgments being made in the needs studies (long-range planning) that are quite at variance with the judgments, with regard to standards, that are made in the design process.

- There is a need to establish now a Freeway System — a network of the most important routes on the State Highway System which, as they are developed, will have controlled access under the provisions of the 1947 Expressway Act.

The Freeway System should consist of the Interstate System and such other major routes as provide a trunkline traffic service of like character. Although there are indications that provisions have been made for some freeways other than Interstate in the 20-year needs study, a formal plan has not been developed to present these routes and the Interstate as an integrated network. There also are indications in the needs study that some routes which deserve to be freeways — by virtue of projected traffic volumes — have not been designated for control of access.

Action formally to establish a Freeway System would go a long way toward giving stability to the long-range planning process. If the principal traffic arterials are classified now for development as controlled-access facilities, there will be assurance that after such facilities have been built they will not lose their effectiveness because of roadside property development. The investment in the highway will be preserved.

In addition to providing a key element of the long-range plan — the objective toward which the Commission should direct its efforts — the Freeway System designation would help the counties and communities throughout the State in the planning of their future development.

- There is a need for a more comprehensive type of planning than that provided by the traditional needs study approach.

The traditional approach has been more concerned with the identification of existing highway deficiencies and measures for correcting these than with a conceptual planning of highway development based on the interrelationship of projected land uses, population characteristics and

traffic service requirements. ^{17/} Particularly with the development of the Interstate System in urban areas, there has grown a science of projecting highway systems requirements through specific relationships with land uses and population characteristics. This science now is being adapted to rural highway planning in some states.

One of the advantages of this kind of planning is the recognition of highway systems interdependence — traffic service provided through a combination of different types of highways, with each having a planned part in the total network. This kind of planning does not eliminate needs determination but provides a better basis for it. With a better understanding of the relationships between developing land uses and traffic generation, there can be more stability in the total long-range objective.

- There is a need for bringing the development of major highways in the City of Baltimore into the framework of the total State Highway System — both for planning and construction.

One of the problems in determining and working toward a total objective of highway improvement is the lack of assigned responsibility to the Commission for major routes in the City of Baltimore. Baltimore is considerably behind the rest of the State in progress toward completion of the Interstate System — as indicated by the status of federal-aid obligations in Part One of this report.

The federal government deals only with the state agency and in effect holds the Commission responsible for the timely completion of the Interstate System, including the important links in Baltimore — over which the Commission has no control.

From the standpoint of planning, it appears logical that the State should have a consistent policy toward urban areas. With the extensive urbanization of Baltimore, Montgomery and Prince Georges Counties, it is difficult to distinguish between the character of problems and state interest in large parts of these counties and in the City of Baltimore.

Prior to 1933, the Commission had responsibility for construction of major highways in Baltimore, although the city was responsible for

^{17/}This statement must be qualified since there always has been an attempt to consider the factors of land use and population characteristics, particularly in connection with needs expected to accrue in the future. However, inclusion of these factors has been on the basis of judgments, rather than scientific analyses.

maintenance of the constructed routes and state-collected highway revenues were paid directly for this purpose. This kind of arrangement is common in many states. Since 1933, state-collected revenues have gone directly to the city for both construction and maintenance purposes.

RECOMMENDATIONS

Recommendation. Adopt policies and procedures and make organizational provisions for a continuous function of long-range highway planning to establish overall objectives for state highway development.

The organizational unit established for long-range planning should be responsible for:

1. Evaluation of highway system requirements, including requirements for a system of freeways to include and supplement the Interstate System.
2. Continuous appraisal of highway improvement needs to attain a total objective for state highway development.
3. Projection of highway revenues from current fiscal provisions and comparison of revenues and needs.
4. Establishment of priorities for highway improvement needs on an objective basis.
5. Preparation of reports detailing the long-range objective and progress toward its achievement.

A recommended policy for highway planning is shown in Exhibit A.

Recommendation. Establish geometric design standards for state highway development.

Standards should be established to meet the terrain and traffic conditions in Maryland. They should represent the minimum acceptable standards for planning and design of roads and bridges. Higher standards should be used when they do not involve increased costs. Lower standards should not be used except under unusual circumstances, and then only with documented justification and approval of the Chief Engineer, Development. ^{18/} A recommended policy for the establishment of geometric standards is shown in Exhibit B.

^{18/} See the organization section of this report for the recommended new organizational structure and positions.

Maryland State Roads Commission
POLICY

Policy No. _____
Date: _____
Page ____ of ____

HIGHWAY PLANNING

POLICY:

The State Roads Commission will prepare, formally adopt and publish a long-range plan for construction and improvement of highways under its jurisdiction, directed toward achievement of an adequate highway system. Sound engineering practices will be applied in determining the needs to be included in the long-range plan. The plan will be continually evaluated, revised and updated to reflect improvements accomplished, remaining deficiencies, accruing deficiencies, revised forecasts of revenues and projections of non-construction expenditure requirements.

From a priority array of projects derived from its long-range plan, the Commission will adopt and publish a construction and improvement program to be accomplished within the following five fiscal years. Such program will be arranged by years and will be revised annually to reflect the work completed or under way and to provide for a continuing five-year program.

The Director of Highways will develop and maintain production schedules on a continuous basis for execution of the approved five-year program. Target dates will be established for the completion of each major activity necessary to advance each project through to its advertising date.

Progress will be monitored and reported against the established target dates; problem areas will be identified, analyzed and resolved; and future workloads will be predicted.

SCOPE:

Upon adoption by the Commission, the long-range plan and the five-year program will constitute official objectives of the Commission in the accomplishment of planning, design, land acquisition, construction and maintenance for the State Highway System. Organization, staffing, budgeting and scheduling within and between the production units of the Commission will be directed toward fulfillment of these objectives.

RESPONSIBILITY:

The Director of Highways will develop and recommend a long-range plan directed toward achievement of an adequate State Highway System. He also will develop and recommend a five-year construction and improvement program within the parameters of the long-range plan and consistent with the financial and physical capabilities of the Commission. He will develop and recommend changes in the plan and the program for annual updating or as may be required by unforeseen or emergency conditions.

The Chief Engineer for Development will coordinate and review the long-range highway improvement planning and programming activities with his division heads, with the Chief Engineer for Operations and with the Deputy Director of Highways. He will ensure that a production schedule is established and maintained for the execution of the approved five-year construction program.

Policy No. _____
Date: _____
Page ____ of ____

The Director of Planning will develop and maintain a continuing comprehensive planning process, for both rural and urban areas, to establish the character and general location of a complete system of highway facilities, integrated with other kinds of transportation and coordinated with community and area development plans. He will develop the needs on the State Highway System and make recommendations for long-range improvement plans directed toward attainment of an adequate highway system. He will relate the long-range plans to revenue forecasts. Upon approval of the long-range plan, he will prepare a priority array of specific projects derived from the long-range plan and recommend a five-year construction program. He will develop and recommend those changes in the plan and the program necessary to keep them current and within the capabilities of the Commission. He will develop and maintain a multiple-project scheduling process to accomplish the approved five-year construction program. He will develop and maintain monitoring and reporting procedures.

All Commission personnel will cooperate with the Chief Engineer for Development in furnishing information and recommendations for formulation of the long-range plan and the five-year program.

The State Roads Commission, with the advice and counsel of the Director of Highways, will review, adjust and approve a long-range plan and a five-year program.

Upon approval by the Commission, the Director of Highways will direct the publication and distribution of the plan and the program and subsequent changes.

All managerial personnel of the Commission will utilize such plan and program as the basis for planning, programming, staffing, budgeting and scheduling their particular functions and operations. They will plan work assignments within their respective units to meet the scheduled target dates set forth in the production schedule. They will furnish the Director of Planning with such information as he may request in conjunction with the long-range planning, programming and scheduling activities.

Maryland State Roads Commission
POLICY

Policy No. _____

Date: _____

Page ____ of ____

HIGHWAY GEOMETRIC STANDARDS

- POLICY:** Optimum highway geometric standards will be established and maintained for all classes of highways consistent with traffic requirements estimated for a minimum future period of 20 years. These standards will be established within the framework of the policies of the American Association of State Highway Officials.
- SCOPE:** Approved highway geometric standards will serve as a guide in the design of new facilities, in the improvement of existing facilities and in the evaluation of existing highway and bridge deficiencies.
- RESPONSIBILITY:** The Chief Engineer for Development will establish and maintain geometric design standards for all classes of highways.
- The Research Committee will advise and assist the Chief Engineer for Development in carrying out this responsibility. The Committee will designate a Research Subcommittee on Highway Geometric Standards composed of representatives of those Commission units normally concerned with the planning, design, construction and maintenance of highways and bridges and traffic operations thereon.
- The Research Subcommittee on Highway Geometric Standards periodically will review current design practices in Maryland, keep apprised of practices in other states and develop changes necessary to provide for the uniform treatment of the geometric elements in accordance with sound principles of engineering and economics.
- Unit heads will be responsible for the proper utilization of approved highway geometric standards within their respective units.
- All Commission personnel may comment on and submit suggestions for revisions in standards through their respective unit heads to the Chairman, Research Subcommittee on Highway Geometric Standards.

Recommendation. Designate a Freeway System for development with controlled access under the provisions of the Expressway Act of 1947.

The Interstate System now is being built continuously to freeway standards and represents a major part of the recommended Freeway System. However, there is need to designate a more extensive system of routes for ultimate development to freeway standards in order that the total needs for these kinds of facilities will become a basic part of the long-range plan. Such designation also can provide the necessary guidance to local communities in the planning of their future development.

Recommendation. Assign the responsibility for the Interstate System and other major routes of state-wide interest in the City of Baltimore to the State Roads Commission, and provide the appropriate share of state highway revenues to the Commission to fulfill this responsibility.

To provide effective coordination of major route development throughout the State, including the City of Baltimore, it is necessary to assign full responsibility to one agency — the State Roads Commission. This need is supported by the present status of Interstate System development in the City of Baltimore. Planning for the urban extensions of major state routes should be performed cooperatively between the Commission and the local jurisdictions involved as provided in Chapter 1 of title 23, United States Code, as amended.

PROGRAMMING

Programming represents the establishment of a specific listing of projects to be placed under construction within a fixed time period. The program provides the basis for organizing the work processes required to accomplish the internal engineering and right-of-way tasks needed for individual projects. The program also gives appropriate advance notice to contractors, materials suppliers, local governments, utilities and other agencies or groups affected by highway development.

The time period must be long enough (about five years) to provide adequate lead time for surveys, design, right-of-way acquisition and other preconstruction activities. However, the time period should not be longer than needed for project lead time, in order to allow as much flexibility as possible in the long-range planning process.

The projects included in the program should be selected from the long-range plan to give proper recognition to priorities and to a logical phasing of construction.

The program magnitude will be determined by forecasts of funds available to carry forward the construction program.

Historically, the Commission has developed and adopted programs of varying lengths — illustrated by the 12-year program and the current six-year program (which is, in reality, a six-year list of projects to be broken into three two-year programs). While the State is to be commended for its forward-looking actions in getting programs adopted, the programs have in one way or another failed fully to accomplish the purposes intended.

One thing lacking has been flexibility. For example, when the 12-year program was adopted, it was required that 90 per cent of the first four years' projects be completed before work could be started on the next four years' projects.^{19/} Because of the varying lengths of time required to process projects, it was not possible in some instances to provide sufficient lead time for processing. Also, it was difficult to incorporate the effects of changing conditions and requirements — such as those associated with inauguration of the Interstate program — in a 12-year program, particularly when there was no provision for year-to-year evaluation of the effects of such changes and adjustment thereto. By the time the first such evaluation and report was made, there already was considerable deviation — in costs and accomplishments — from the original program.

In 1964, the procedures for program development and accomplishment were altered — the Commission now being required to develop and approve a list of projects to be let to contract within the six-year period 1965-1970 and to group these into three two-year programs. Each two-year program must be prepared on an individual county basis and show the month and year when engineering, right-of-way acquisition and construction are scheduled to begin. Counties must approve each two-year program and may change project priorities and substitute primary and secondary projects — on a cost basis — from the 20-year needs study and the six-year program report. Upon county approval, the Commission must adhere to the program and schedules developed.^{20/} This procedure may well prove unrealistic, for the following reasons:

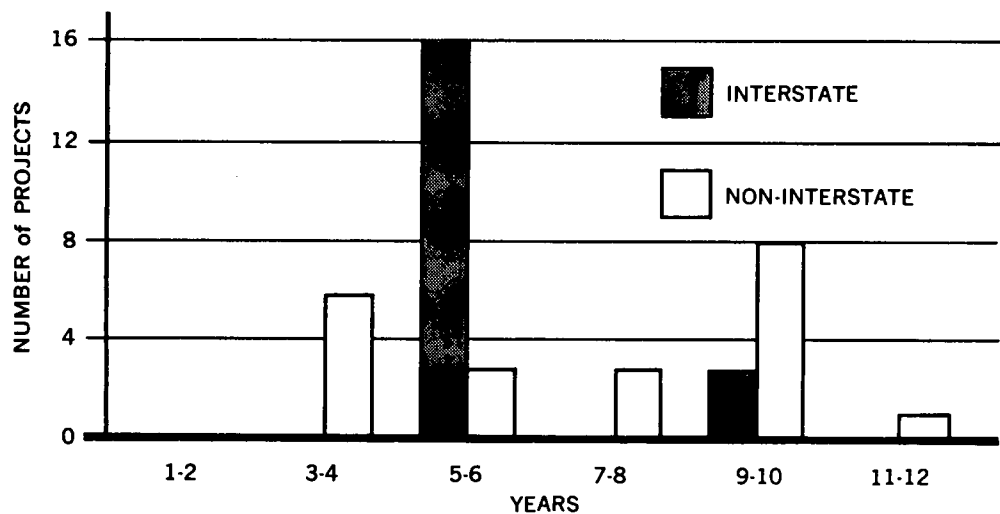
1. Historical data relative to time required for processing projects from authorization to advertising for letting indicate that there will be a lack of adequate lead time to process all projects in the first two-year program. The data in Figure 13 show that of all projects on new location advertised for letting during the period January 1 to August 31, 1964, no construction project required less than three years to process.^{21/}

^{19/} This requirement was deleted in 1960.

^{20/} This procedure is established by statutory provision, enacted by the General Assembly in 1964.

^{21/} Processing time does not necessarily mean continuous work, since some activities may have been dormant for portions of the time shown.

Figure 13
TIME
REQUIREMENTS
FOR PROJECT
DEVELOPMENT^{1/}



^{1/} All construction projects on new location let to contract between January 1 and August 31, 1964. Development is defined as the processes between authorization and letting.
Data: State Roads Commission.

As of July 1964, there were 14 projects in the current two-year program calling for construction on new location for which engineering work had not started.

2. Revised time estimates for completion of right-of-way acquisition on projects in the current two-year program indicate that 22 projects for which engineering has not yet started may not be cleared for letting until some time past the close of the two-year program period.^{22/}
3. The substitution provisions can, under certain circumstances, affect the meeting of program target dates. If counties substitute projects on which no processing work has been accomplished for those on which processing has begun, the latter must be shelved. There is great probability that there will be insufficient lead time to meet the target date for the substituted projects.^{23/}

Analysis also indicates the need for attention to sequencing of projects, as illustrated by an example on U. S. 13. The present two-year program calls for the construction of two bridges and 1.75 miles of pavement on U. S. 13 in Worcester and Somerset Counties at an estimated cost of 2.3 million dollars. However, failure to provide for

^{22/} From data furnished by the Right-of-Way Division.

^{23/} In the formulation of the current two-year program, 13 counties approved the Commission's program without change and 10 substituted projects. It cannot accurately be determined at this time what the effects of the substitutions will be insofar as meeting target dates is concerned.

construction of a connecting link of less than two miles would defer use of these bridges for some time.

Another example is the Commission's proposal to reconstruct 1.2 miles on Maryland Route 32 in Howard County to provide access to proposed Interstate Route 95. During the formulation of the 1965-66 program, Howard County removed the project by substitution. As a result, it now appears questionable that the U. S. Bureau of Public Roads will approve an interchange on I-95 even though it previously had been justified.

Conclusions can be drawn with regard to programming as follows:

CONCLUSIONS

- Because programming is an essential process in attaining an orderly approach toward long-range highway development objectives, it is necessary that the Commission have sufficient latitude to do the programming. The current legislative provisions for the three two-year programs represent undesirable limitations on the Commission in effecting adequate lead times for engineering and right-of-way acquisition.

It is understood that the present legislative provisions for programming have developed because of concern that local interests have not received proper consideration in state highway programs. However, consideration of local viewpoints and the coordination of state highway plans with communities primarily should be effected as part of the long-range planning activity, not as part of the programming and scheduling activities. The concern and the action of the General Assembly simply confirm what was pointed out earlier — that there is an urgent need for an effective long-range planning process.

- The Commission should have a definite program of projects for letting to contract over a period of not less than three years, but preferably for five years. Program development should be a continuing process, with another year added as a year expires.

A program of this nature would provide the basis on which to organize the various functional units of the Commission efficiently to carry out their responsibilities in performing preliminary engineering, design, right-of-way acquisition and other activities preliminary to the letting of construction projects. It also would provide contractors, materials suppliers and utility companies with advance information on the work program so they could make their plans and organize to provide their services efficiently and with maximum economy.

Recommendation. Adopt a system of programming which will make provision for a continuously updated five-year program of expected construction project accomplishments.

To effect this recommendation, several actions will be required by both the General Assembly and the Commission.

One of these actions is adoption by the General Assembly of the concept that the Commission has complete authority and responsibility to develop and accomplish highway programs. Existing legislation then should be amended to remove restrictions on the Commission's flexibility to (1) determine the length of program needed to provide adequate lead times, and (2) make final decisions on improvement projects to be included in the program.

The Commission should adopt policies and procedures and make organizational provisions for carrying out a continuous programming process to provide a five-year program — with a year added as a year is accomplished. ^{24/}

To gain public confidence and support, the Commission should report to the public on a regular annual basis — such report to show the projects in the currently approved program and the status of accomplishment on projects in the approved program for the previous year. Any changes in the program should be explained with details of the circumstances or conditions requiring the change.

With this degree of flexibility, the Commission should be held accountable for reasonably effective accomplishment of the programs as set forth.

SCHEDULING

Scheduling is the process of developing, monitoring and controlling an action plan for accomplishment of the approved construction program. It includes the following activities:

1. Determining and arranging the activities necessary to produce a project for letting in logical sequence.
2. Estimating time requirements for completion of major activities.
3. Establishing target dates for completion of major activities.
4. Correlating the various activities in one project with those of other programmed and concurrent projects.

^{24/} The programming activity is included in the recommended policy on highway planning (Exhibit A).

5. Developing production schedules wherein the workload of each production unit is spelled out.
6. Receiving feedback information from production units and interpreting these data to monitor progress on the schedule.
7. Issuing management reports relative to program, project and activity status, along with situation appraisals requiring management decisions.

The result of effective scheduling should be an orderly processing of projects through each major activity, the meeting of letting dates and a fully-informed management with the necessary tools to make scheduling and programming decisions.

A scheduling procedure for processing projects to the advertising stage presently is followed in the Commission. The major elements of this procedure are as follows:

1. The Commission is required to establish the starting dates for engineering, right-of-way acquisition and construction for each of the projects included in each of the two-year programs for the six-year period 1965-1970.^{25/}
2. Once starting dates are established, coordination of progress is carried out at periodic meetings of the Chairman-Director, the Chief Engineer and the major division heads. The status of projects in the program is reviewed at these meetings.
3. The Chief Engineer maintains a bar-graph showing each project and its status. Each bureau maintains a status report of the projects currently assigned to it.

This scheduling procedure has been in operation since July 1964. Previously, staff meetings exclusively were utilized to coordinate progress, and advertising dates were revised frequently under this system.

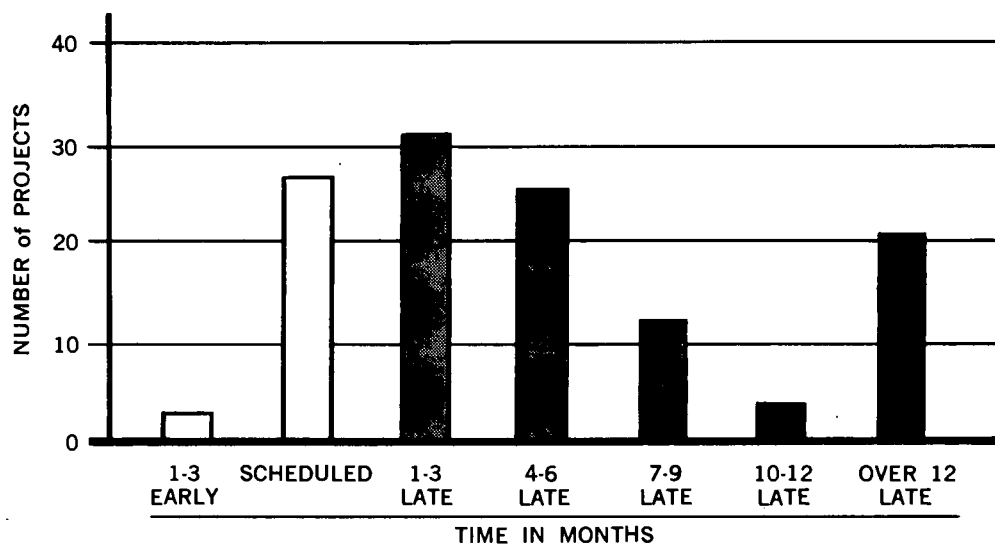
Results of a study of projects scheduled for advertisement between April 22 and December 31, 1963, are shown in Figure 14. These data indicate that of the 126 projects scheduled for advertising during this period, 30 projects were advertised in or before the scheduled month and 96 projects — 76 per cent of the total — were advertised after the scheduled month.

^{25/} This procedure is required by statutory provisions enacted in 1964. Previously, scheduling was limited to the setting of advertising dates for projects in the programs.

Figure 14

SCHEDULED AND ACTUAL ADVERTISING DATES

PROJECTS SCHEDULED
FOR LETTING APRIL 22
TO DECEMBER 31, 1963



Data: State Roads Commission.

While the current procedure represents an improvement, further modifications are needed if desired results are to be obtained.

TIME FACTORS

There are two basic time concepts fundamental to scheduling :

1. Activity time — the total time that elapses from initiation to completion of an activity.
2. Lead time — the time prior to the proposed project completion date that an activity must be initiated to allow for subsequent activities.

The lead time for initiation of an activity on a given project is simply the sum of the activity time for that activity and all others which follow it in arriving at the completion date. Therefore, while consideration also must be given to the effect of delays of various sorts, estimates of activity times form the foundation of the entire scheduling process.

Activity times are not rigid, and time required for accomplishment of each activity will be affected by:

1. The characteristics of each individual project.
2. The resources and effort applied to each project.
3. The nature of the activity.
4. Delays.

Judging by experience in meeting schedules in the past, insufficient attention has been given to these factors in setting up activity

times. The factor of resources and effort applied to each project is especially significant. While it may be relatively easy to determine the time required to complete an activity on a single project with available resources — such as personnel — it becomes much more difficult to estimate activity times when there are several concurrent projects making a demand on available resources. The following data show the complexities of the problem and the probable results of making inadequate provisions for an analytical scheduling process.

Every state highway construction project on new location let between January 1 and August 31, 1964, involved three or more years for completion of preliminary engineering and right-of-way acquisition. On more than half of the non-Interstate projects for that period, seven or more years elapsed from beginning to end of these activities. For all the Interstate projects, five or more years were required (see Figure 13). Such data do not mean that each individual project could have been processed in a shorter time period assuming use of greater resources and effort. It is clear, however, that processing projects in a multiple-project situation has required initiation of early activities on most projects five and more years in advance of construction.

In July 1964, the status of projects included in the first two-year program was as shown in Figure 15. These data indicate that engineering work was completed or under way on 63 projects; was scheduled to begin in July on 32 projects; was scheduled to begin in August, September or October on 20 projects. The status of 11 projects was undetermined. Since engineering was not even scheduled to start by the beginning of the two-year period on at least 52 projects, some of which are on new location, letting of these projects on time may not be possible.

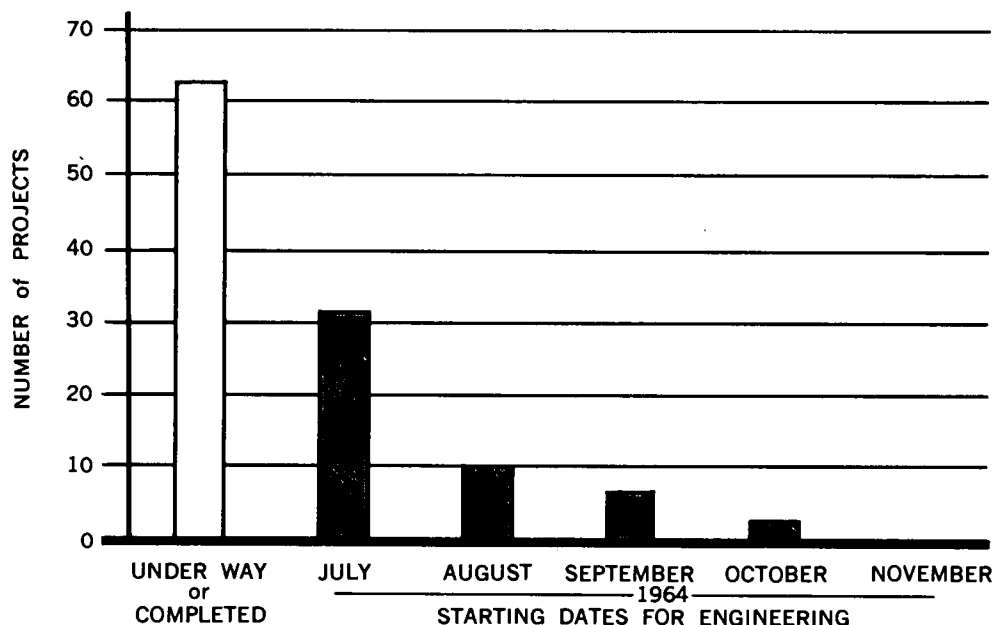


Figure 15

ENGINEERING SCHEDULE

STARTING DATES FOR
CURRENT TWO-YEAR
PROGRAM

STATE PRIMARY AND
SECONDARY SYSTEMS

Data: State Roads Commission.

It is significant, and indicative of the crash nature of the current program, that if adequate lead time were provided an average of only five projects would have to be started each month.

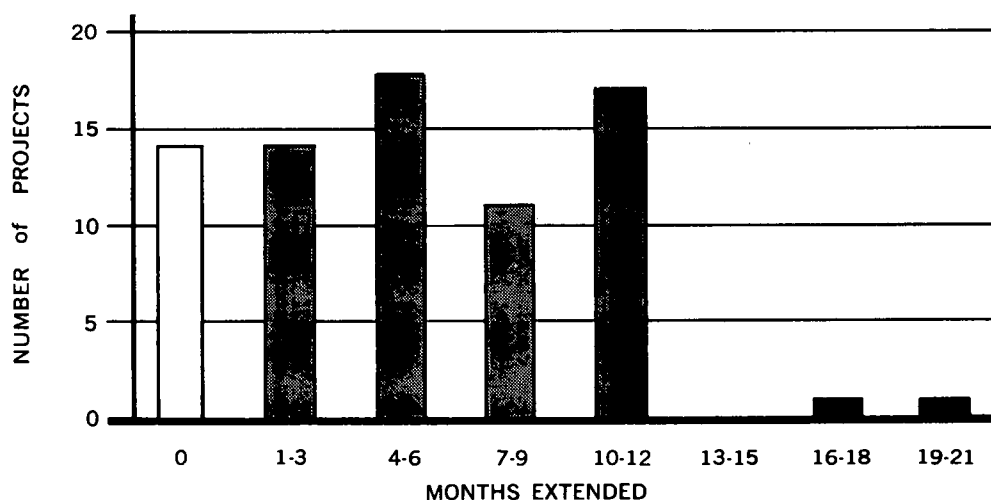
DELAYS

While delays may be largely unpredictable, and may vary from the loss of a day to losses of months and even years, they almost always are present. Some consideration must be given to them in overall lead time, and the scheduling system must provide for orderly adjustments when they are encountered. The shorter the program period, the more difficult it becomes to adjust for such delays and still complete projects on time. Recent experience with delays includes the following:

1. Expenditure of funds for engineering involving six projects on the new Patapsco Neck Expressway had not been authorized by the middle of October 1964 even though engineering was scheduled to start in July 1964.
2. At least two counties did not approve the state highway construction program until August 1964 even though engineering was scheduled to start in July 1964.
3. Recently-revised estimates of completion dates for right-of-way acquisition on projects in the two-year program will extend advertising dates on many projects from one to 20 months, as shown in Figure 16.

Figure 16

**INDICATED
DELAYS ^{1/}**
TWO-YEAR CONSTRUCTION
PROGRAM (1965-66)
STATE PRIMARY AND
SECONDARY SYSTEMS



^{1/} Based on revised estimates for completion of right-of-way acquisition. Assumes advertising dates fall two months after acquisition is completed, but extensions not necessarily due to extra time in the right-of-way function.

Data: State Roads Commission.

SCHEDULE ADJUSTMENTS

In view of the foregoing factors, it will be extremely difficult to complete the present two-year program on time. If target dates are to be adhered to, management has but one alternative — adjustment of

the resources and effort applied to each specific project. This can be done, provided the required resources exist and are not already devoted to work of equal or higher priority. The nature of some activities, however, prevents reduction of elapsed times beyond certain minimums regardless of the magnitude or efficiency of the effort applied.

In the event that current schedule problems cannot be solved by such adjustment, management has no alternative but to effect changes in the schedule — by deleting projects, by changing project priorities, by revising the order in which projects are to be processed, by extending target dates for completion, or by combinations of such adjustments.

In a situation where many projects are being processed concurrently through 30 or more major activities — as in Exhibit C, for example — the effect of any such change is widespread. To maintain a high level of efficiency and a balanced workload and avoid excessive shelving and subsequent reactivation and reworking of projects, it is necessary that initial activity time estimates and lead times be as realistic as possible.

More realistic time estimates and lead times might present a less optimistic view of anticipated accomplishment. Such a view, however, would (1) provide a firmer basis for communication with the General Assembly, contractors, materials suppliers and others, (2) provide a sounder basis for decision-making, and (3) permit more efficient use of manpower and other resources throughout the Commission.

Increased capability to balance workloads would be one of the most noticeable effects of improved time estimates and more lead time. Survey work scheduled to be under way during the period from September 1964 to July 1965 is shown in Figure 17. The sharply decreasing amount of work scheduled as the two-year period progresses illustrates a basic problem created by the present system of program development and scheduling — lack of balance in the workload when the program period is too short.

BALANCING WORKLOADS

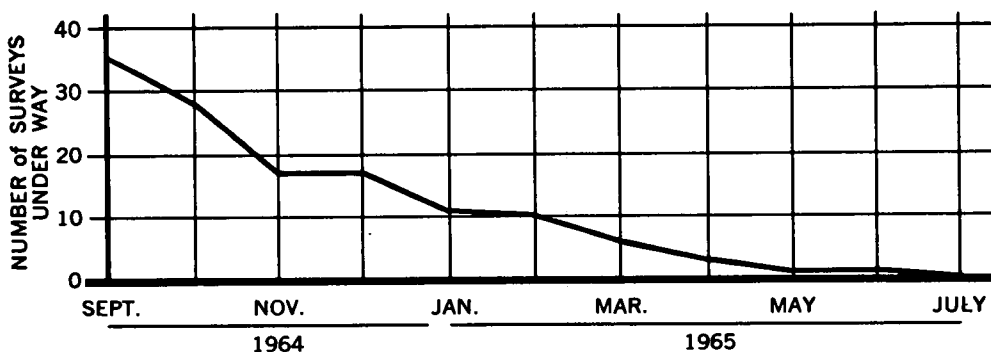


Figure 17

SURVEYS SCHEDULE

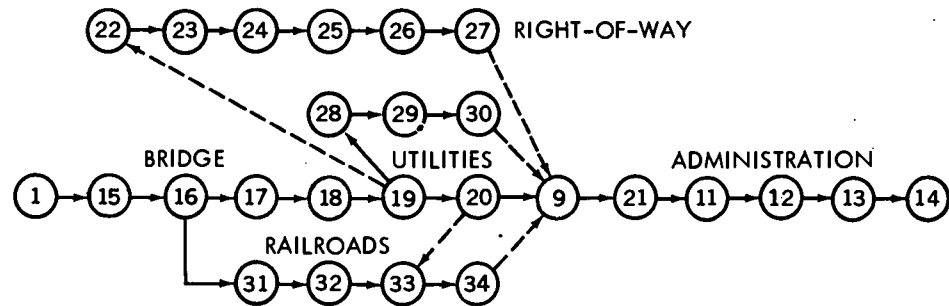
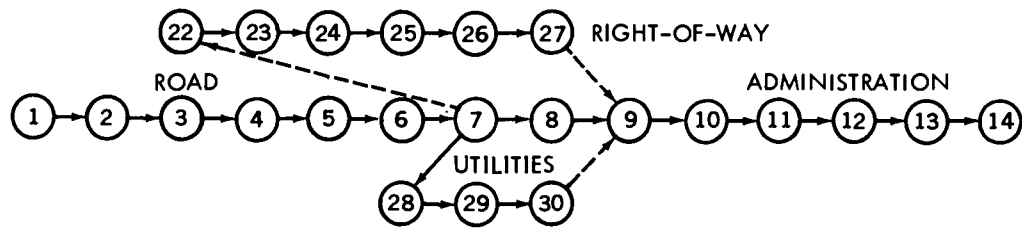
STATE HIGHWAY PROGRAM ^{1/}
JULY 1, 1964
TO
JUNE 30, 1966

^{1/}Includes Interstate projects.
Data: State Roads Commission.

Exhibit C TYPICAL WORK FLOW DIAGRAM

Maryland State Roads Commission

PRODUCTION SEQUENCE FOR IMPROVEMENT PROJECTS



SCHEDULING MILEPOSTS

- | | |
|---|--|
| 1. Origin. | 18. Bureau of Public Roads Approval of Preliminary Bridge Plans. |
| 2. Road Survey Complete. | 19. Bridge Plans to R/W. |
| 3. Bureau of Public Roads Approval of Preliminary Grade and Geometrics. | 20. Final Bridge Plans Signed. |
| 4. Road Preliminary Field Check. | 21. Bridge Plans to Bureau of Public Roads, Pre-Letting. |
| 5. Road Sails Investigation Complete. | 22. Start R/W. |
| 6. Road Final Field Check. | 23. Abstracting Complete. |
| 7. Road Plans to R/W. | 24. R/W Engineering Complete. |
| 8. Final Road Plans Signed. | 25. Appraising Complete. |
| 9. Junction. | 26. Negotiating Complete. |
| 10. Road Plans to Bureau of Public Roads, Pre-Letting. | 27. R/W Clear. |
| 11. Bureau of Public Roads Approval of Final Plans. | 28. Utility Receipt of First Plans. |
| 12. Letting. | 29. Utility Execution of Agreement. |
| 13. Contract Award. | 30. Utility Agreement Complete. |
| 14. Open to Traffic. | 31. Improvement Plan Approved by Railroad. |
| 15. Bridge Survey Complete. | 32. Federal-Aid Estimate Received from Railroad. |
| 16. Bridge Sails Barings Complete. | 33. Final Agreement Approved by Railroad. |
| 17. Preliminary Bridge Plans to Bureau of Public Roads. | 34. Final Plans Approved by Railroad. |

The Commission should now be scheduling survey work on projects in the second two-year program.^{26/} Considering the approval status of the program at present, if surveys are scheduled now for projects in the ensuing two years, future substitutions of projects for that period may result in completed work being set aside. This may necessitate a crash program for the newly substituted projects — thereby further disrupting the schedule.

The distribution of the right-of-way acquisition workload for the current two-year program is shown in Figure 18. It should be noted that the number of projects scheduled to be under way during the period July 1964 to July 1966 fluctuates from four in July 1964 to a peak of 46 in June 1965, with a low of two in the last month of the period. Here again, the difficulty of effectively using the work force is illustrated.

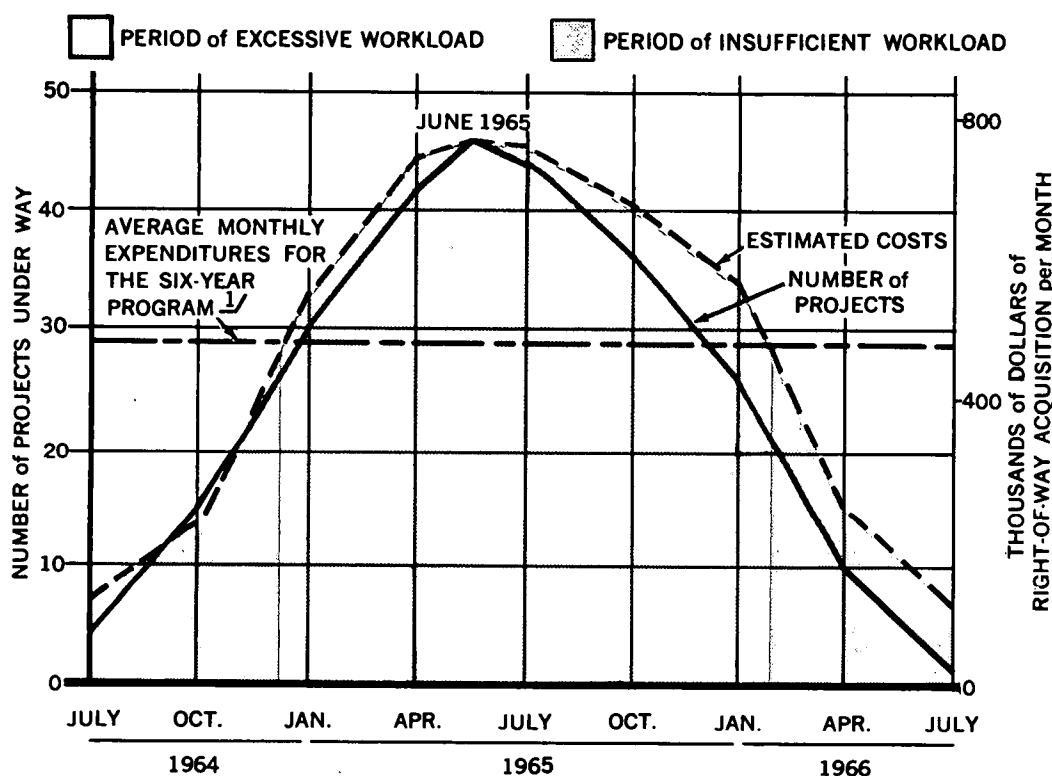


Figure 18

PEAK LOADS IN RIGHT-OF-WAY ACQUISITION SCHEDULE

STATE PRIMARY AND SECONDARY CONSTRUCTION PROGRAM

^{1/} Assumes nine months required for right-of-way acquisition.

Data: State Primary and Secondary Construction Program, July 1, 1964 to June 30, 1966 and Highway Construction Program, fiscal years 1965-1970.

Not only is fluctuation from maximum to minimum effort a problem, but problems also are encountered in attempting to determine the personnel complement that should continuously be employed for maximum effectiveness and economy:

^{26/} Under existing statutory enactments, it is questionable whether work beyond the current approved two-year program can be performed — other than within the present authorization for advance preliminary engineering.

1. It is doubtful that the Right-of-Way Division can fulfill the schedule requirements from January 1965 to approximately January 1966, if staffed for an average right-of-way acquisition workload.
2. It appears that there will be substantial over-staffing for other periods if the division is staffed for the maximum effort in June 1965.

Although such problems can be reduced through use of outside services — such as fee appraisers — improvement of efficiency and economy would require development of a better basis for evaluating and balancing the workload. This can be accomplished only through the approval of a firm program for a sufficiently long future period.

CONCLUSIONS

Scheduling of activities in the Commission has been hampered by inadequate lead time and overly optimistic time estimates. Rather than a series of firm target dates to serve as a basis for plans and decisions, a generally unreliable picture has been presented. This has resulted in several problems as indicated by measurable data:

1. Scheduled advertising dates frequently have not been met.
2. Completion of the first two-year program on time is improbable.
3. Manpower needs vary widely and are difficult to analyze.

There is a need for a more sophisticated scheduling, monitoring and control system.

Recommendation. Develop and operate a multiple-project scheduling system to establish target dates for completion of each major activity required to execute the projects in the approved highway construction program.

To produce an approved set of plans, specifications and estimates for advertising generally requires completion of about 35 to 40 major activities. Assuming an average of 100 lettings per year, a five-year program would involve the coordination and completion of roughly 20,000 major activities — many of which are concurrent.

The solution to the problem of properly orienting these activities involves a close coordination between the programming and scheduling processes. Normally, the first few years of the construction program require a precisely detailed schedule.

In the formulation of this schedule, it is necessary to establish the workload in each organizational unit by developing a target date for the completion of each major activity for each project in the schedule. Each organizational unit then should be required to exert maximum effort to meet the target date. Delays or overruns in any given activity on any one project may affect all following activities for the same project, as well as some activities on other projects.

In some instances, delays may be unavoidable, but their effect on subsequent activities, on the advertising date and on other projects should be known so that management can decide on the course of action to be taken. The decision may be to meet the established target date by diverting personnel from an activity with a surplus of time, or to delay a less important project, or to contract for the work outside the Commission.

Once the workload in a given activity or group of activities is known by the organizational unit responsible for execution, it can be used to anticipate and provide for future manpower requirements.

The above actions can best be accomplished by developing and operating a multiple-project scheduling system geared to:

1. Produce and maintain a master production schedule.
2. Produce and maintain production schedules for specific organizational units.
3. Produce estimates of resource requirements.
4. Provide management with the essential tools for making scheduling decisions.

Although it may be possible to develop a manual scheduling system that will fulfill the above requirements, the quantity and complexity of the operations required can best be performed by electronic data processing methods.

A recommended procedure for production scheduling is shown in Exhibit D.

Exhibit D RECOMMENDED PROCEDURE

Maryland State Roads Commission
 PROCEDURE
 Issued by Director of Planning

Procedure No. _____
 Date: _____
 Page _____ of _____

PRODUCTION SCHEDULING

AUTHORITY: This procedure has been prepared by the Bureau of Scheduling, approved by the Chief Engineer for Development and issued by the Director of Planning in accordance with State Roads Commission Policy No. _____ dated _____, entitled "Highway Planning".

PURPOSE: To establish the procedure for developing and maintaining production schedules to execute the Commission's approved five-year highway construction program.

To establish the procedure for monitoring and controlling production progress.

PROCEDURE FOR SCHEDULING:

Responsibility	Action
Chief, Bureau of Programming	1. Submit approved highway construction program to the Chief, Bureau of Scheduling.
	2. Inform the Chief, Bureau of Scheduling of subsequent program changes affecting the production schedule.
Chief, Bureau of Scheduling	3. Develop and maintain a continuous multiple-project scheduling process using electronic data processing to the maximum extent practicable.
	4. Determine scheduling requirements and request specific activity time for each project to be scheduled from unit supervisors, squad leaders, group leaders, section managers and bureau chiefs.
Unit Supervisors Squad Leaders Group Leaders Section Managers Bureau Chiefs	5. Provide time estimates for completion of specific project activities upon request of the Bureau of Scheduling.
Chief, Bureau of Scheduling	6. Compile, analyze and maintain current time estimates for each major project activity.
	7. Develop a master production schedule showing the target date for completion of each major activity necessary to advance all programmed highway improvements through to the advertising stage. The schedule will include all activities whose target dates for completion fall within at least the subsequent 18 months.
	8. Submit master production schedule through the Director of Planning to the Chief Engineer, Development for approval.

Procedure No. _____

Date: _____

Page ____ of ____

- | | |
|---|--|
| Chief Engineer,
Development | 9. Review and approve master production schedule. |
| Chief, Bureau of
Scheduling | 10. Develop and distribute production schedules for selected individual and group activities based on the requirements of the master production schedule. |
| Director of Planning | 11. Provide direction and guidance to the Chief, Bureau of Scheduling on production scheduling activities. |
| Chief, Office of
Administration | 12. Ensure availability of data processing and reproduction facilities for prompt processing of scheduling workload. |
| Unit Supervisors
Squad Leaders
Group Leaders
Section Managers
Bureau Chiefs
Division Directors | 13. Organize and schedule workload assignments to ensure that established target dates for completion are met. |
| | 14. Ensure that consultants and contractors engaged in scheduled activities meet production schedule requirements. |
| | 15. Furnish required data to other units at the earliest possible date to ensure compliance with each unit's scheduled workload. |
| Division Directors | 16. Ensure that all subordinate managerial personnel understand these procedures and that they are carried out in a prompt and efficient manner. |
| Chief, Office of
Administration | 17. Ensure that completion dates in consulting contracts involving scheduled activities provide for accomplishment of work to meet production schedule target dates. |
| Director, Right-of-
Way Division | 18. Ensure that agreements with utilities and railroads provide for accomplishment of necessary work to meet production schedule target dates. |
| Chief, Bureau of
Scheduling | 19. Revise production schedules and distribute change notices to reflect authorized schedule changes. |

PROCEDURE FOR
MONITORING
AND CONTROL:

- | Responsibility | Action |
|--------------------------------|---|
| Chief, Bureau of
Scheduling | 1. Develop, recommend and maintain a monitoring and control process using electronic data processing to the maximum extent practicable. |
| Chief Engineer,
Development | 2. Approve the monitoring and control process. |
| Chief, Bureau of
Scheduling | 3. Prepare and distribute detailed instructions for project activity progress reporting. |

Exhibit D (continued)

Procedure No. _____

Date: _____

Page _____ of _____

- | | |
|---|---|
| | 4. Provide continuing guidance to managerial and supervisory personnel in the preparation of project activity progress reports. |
| Unit Supervisors
Squad Leaders
Group Leaders
Section Managers
Bureau Chiefs | 5. Prepare and submit project activity progress reports in accordance with the detailed instructions issued by the Bureau of Scheduling. |
| Chief, Bureau of Scheduling | 6. Process project activity reports and monitor progress against scheduled target dates. |
| | 7. Identify, analyze and report problem areas to the bureau chief responsible for the activities concerned and to the Chief Engineer, Development. |
| Bureau Chiefs | 8. Investigate problem areas for alternative solutions. Ensure that all reasonable measures have been exhausted before proposing changes in scheduled target dates. |
| | 9. Review all proposed target date changes with their division directors prior to submission of project activity progress reports involving delays in meeting scheduled target dates. |
| Chief, Bureau of Scheduling | 10. Report proposed changes in the scheduled target dates and their affect on the schedule to the Chief Engineer, Development. |
| | 11. Identify those changes affecting one or more activities but not affecting the letting date. |
| | 12. Identify all proposed schedule changes affecting the scheduled letting date. |
| Chief Engineer, Development | 13. Review production problem areas with division directors and bureau chiefs. Evaluate alternative solutions and resolve all production changes not affecting scheduled letting dates. |
| | 14. Approve all production schedule changes except those affecting or delaying scheduled letting dates. |
| | 15. After ensuring that all reasonable corrective measures have been exhausted, recommend schedule changes delaying scheduled letting dates to the Deputy Director of Highways. |
| Deputy Director of Highways | 16. Review, approve and authorize production schedule changes affecting the target date for letting to contract. |
| Chief Engineer, Development | 17. Instruct the Director of Planning to effect approved production schedule changes. |
| Director of Planning | 18. Institute production schedule change procedures. |
| Chief, Bureau of Scheduling | 19. Change production schedule. |
| | 20. Prepare and issue production schedule change notices to all managerial and supervisory personnel. |

Highway planning is largely a process of continuous and progressive refinement — one step leading to another — from development of the long-range plan, to formulation of a specific improvement program, to scheduling for accomplishment of the program. Each step is subject to continual review, analysis, adjustment and extension for a specific future time period. The activities involved are closely related, frequently utilize common data and, collectively, provide the basis for establishment of organization objectives — both broad and specific.

ORGANIZATION FOR PLANNING

Organization for planning should provide for (1) specific identification of each step in the total planning process, (2) close coordination of related activities, and (3) clear definition and delegation of authority and responsibility for the entire process.

Collection and analysis of general statistical data — related to highway finance, motor vehicle registrations, motor fuel consumption, population and land use, road inventory and mapping — presently is performed by the Commission's Planning and Programming Division and by the Bureau of Traffic in the Engineering Division.

PRESENT ORGANIZATION

Definition of improvement projects, assembly of project data, compilation of programs and estimates, and federal-aid programming activities are performed by the Planning and Programming Division.

Collection and analysis of traffic and highway-use data — including origin and destination studies, traffic volume statistics and data regarding the types, sizes and weights of vehicles using the highways — is performed by the Bureau of Traffic in the Engineering Division.

Analysis of locations and types of highways required — the analysis needed to establish corridor locations and basic design needs, as opposed to actual design functions — is performed by the Bureau of Location and Surveys in the Engineering Division.

Coordination and communication with local planning agencies and the general public — concerning proposed highway locations and their effects on land use — is accomplished by the Bureau of Development in the Engineering Division.

Comprehensive transportation planning — total area planning for highway, road and street development, considering both effects of land use on traffic and effects of proposed highway improvements on future land use — is performed only for urban areas at present, and is carried on by the Office of Urban Transportation Planning, which is responsible to the Chairman-Director.

Highway needs studies — based on comprehensive inventories of highways, roads and streets and evaluation of their condition — have

been coordinated by management personnel of the Planning and Programming Division and performed by task forces including personnel from various units of the Commission organization and private consultants.

Interstate program cost estimates also have been made by task forces specifically designated for this purpose.

Scheduling activities — including time estimation, setting and adjustment of target dates and monitoring of progress — are carried out by the Commission, by the Chairman-Director at meetings with division heads, by the Chief Engineer and by the divisions involved in processing each project.

CONCLUSIONS

Study of the present organization for planning leads to the following conclusions:

- There is need to define the purpose and scope of planning activities so they more nearly conform to a continuing, step-by-step planning effort.

The present scope and definition of planning activities precludes the clear identification and setting of objectives for each step of the planning process. It is difficult to determine if and where each essential step is accomplished, and evaluation of performance in each activity is not possible.

- Individual activities should be regrouped to facilitate communications, coordination and correlation of results.

Under present conditions, communications must cross major organizational lines. Even with close and active cooperation between the groups and individuals involved, proper correlation of results and conclusions requires constant attention. Grouping of related activities under common management and supervision would create a more favorable climate for such correlation.

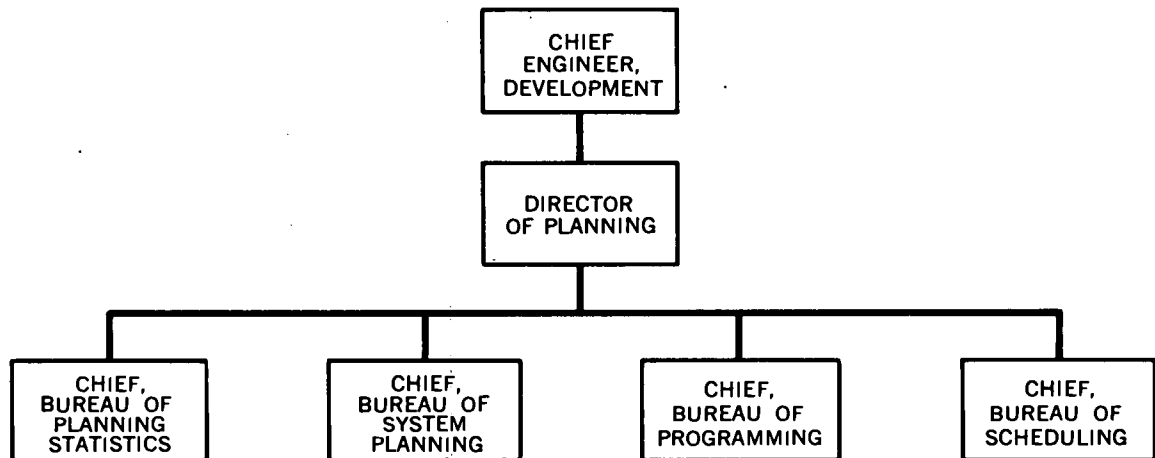
- Authority and responsibility for the total planning effort should be clearly delegated.

Authority and responsibility for the planning effort presently are divided. Top management cannot turn to a specific source for answers to all planning questions. Accountability for planning results is diffi-

Figure 19

RECOMMENDED ORGANIZATIONAL STRUCTURE ^{1/}

PLANNING DIVISION



FUNCTION	FUNCTION	FUNCTION	FUNCTION
1. Establish policies and procedures relative to: <ul style="list-style-type: none"> • inventory and mapping • collection, recording and analysis of traffic statistics • collection and analysis of cost statistics • needs analysis 2. Actively plan, direct, coordinate and control functional activities outlined above.	1. Establish policies and procedures relative to: <ul style="list-style-type: none"> • comprehensive urban and rural highway transportation planning • location planning and economic studies • coordination with local planning agencies • public hearings 2. Actively plan, direct, coordinate and control functional activities outlined above.	1. Establish policies and procedures relative to: <ul style="list-style-type: none"> • project priorities • program development • program management • federal-aid programming 2. Actively plan, direct, coordinate and control functional activities outlined above.	1. Establish policies and procedures relative to: <ul style="list-style-type: none"> • production scheduling • schedule monitoring • production progress and status reports 2. Actively plan, direct, coordinate and control functional activities outlined above.

^{1/} See organization section of the report for recommendations defining relationship of planning to total organization.

cult to ascertain, and assurance that plans, programs and schedules reflect a valid evaluation of all pertinent factors cannot be achieved.

Recommendation. Adopt the concept that highway planning in the Commission will consist of three processes — long-range planning, program development and scheduling — and adopt the organization for planning shown in Figure 19.

This organizational structure will require the transfer of specific planning activities and personnel to the Planning Division from the existing Bureau of Traffic Planning, the Bureau of Location and Surveys, and the Development Unit of the Bureau of Design.



Preconstruction

Preconstruction activities are those which must be carried out after a project has been defined and approved but before it can be constructed. They are considered herein under two broad headings — preliminary engineering and right-of-way acquisition.

Evaluation of the performance of the State Roads Commission in carrying out preliminary engineering activities is extremely difficult. This is due in part to the heavy reliance on consultants to perform much of these activities, and to an inability to identify the work of personnel in the different functional units with specific work activities and projects.

Some rather general analyses were made, however.

Comparison of expenditures for consultant services and construction expenditures for fiscal years 1954 through 1964 is shown in Figure 20.

PRELIMINARY ENGINEERING

UTILIZATION OF CONSULTING ENGINEERS

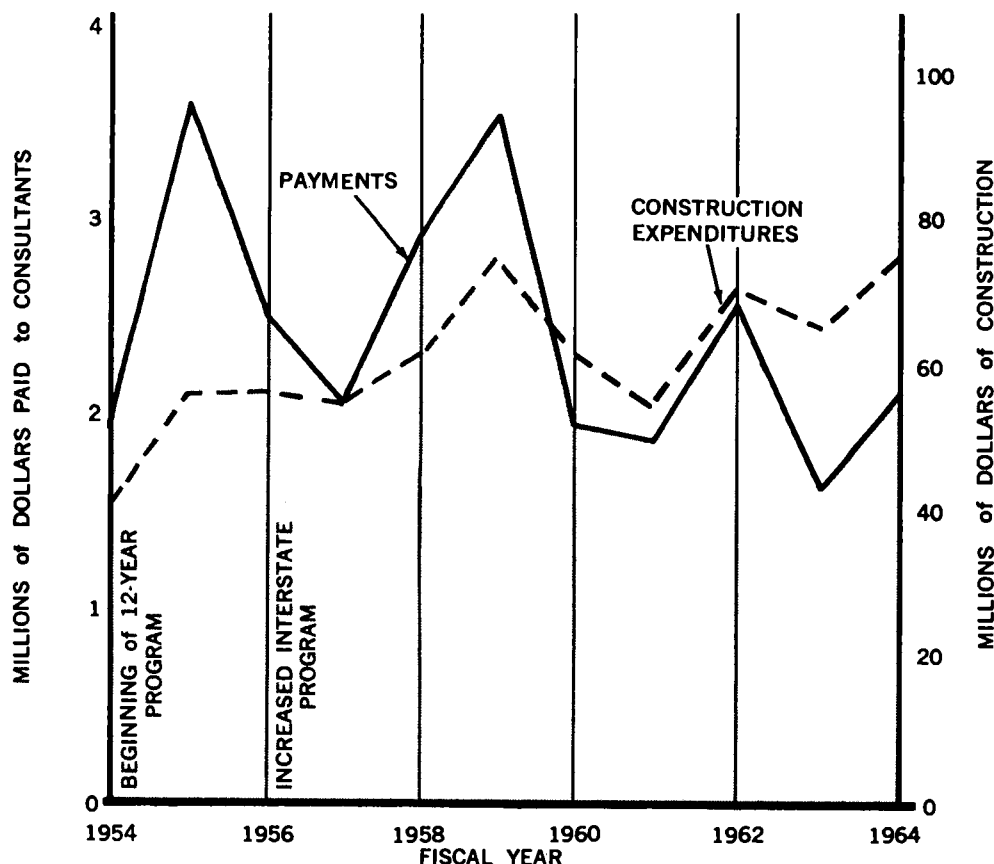


Figure 20

CONSULTING ^{1/} ENGINEER COSTS

^{1/} Payments to consulting engineers for study, design, inspection and other services for the State Highway System — excluding the Baltimore Harbor Tunnel and the John F. Kennedy Memorial Highway.

Data: Finance and Accounting Division and biennial reports, State Roads Commission.

The data indicate that:

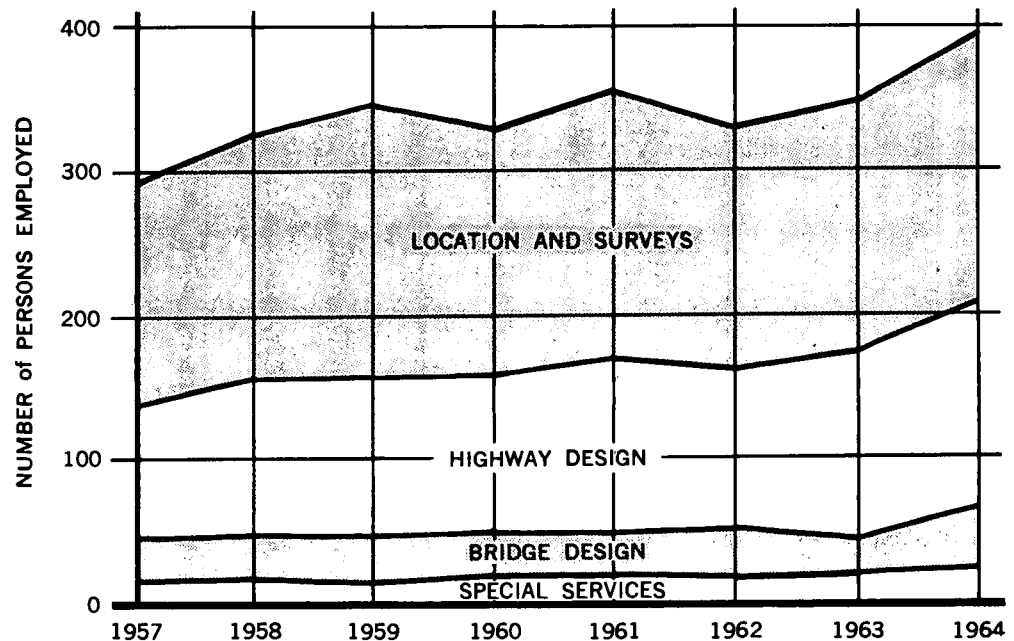
1. Expenditures for consultant services have diminished while construction expenditures have increased.
2. Use of consultants has increased after adoption of new programs — such as the 12-year program in 1954 and the Interstate program in 1956.
3. Payments to consultants have been substantial — never below 1.6 million dollars annually in the past 10 years.

WORKLOAD AND PERSONNEL TRENDS

The number of persons engaged in preliminary engineering activities within the Engineering Division over the past eight years is shown in Figure 21. Study of these data in comparison to total construction expenditures and payments to consultants — shown in Figure 20 — reveal that:

1. The number of preliminary engineering personnel has grown while consultant payments have decreased.
2. The number of preliminary engineering personnel has grown at a slower rate, percentage-wise, than construction expenditures.
3. The growth in number of personnel engaged in this function has been general and is not primarily traceable to any one particular activity.

Figure 21
**STAFFING TRENDS
IN PRELIMINARY
ENGINEERING**
(excluding the soils function)



Data: Bureau of Personnel, State Roads Commission.

If the preliminary engineering workload is assumed to be roughly proportional to the dollar volume of construction processed — and work accomplished by consultants proportional to payments for consultant services — then general gains in efficiency have been made in preliminary engineering.

Efficiency undoubtedly could be further increased by development of greater capability to determine future workloads. Part of the current reliance on consultants for a major portion of the preliminary engineering work is brought about by uncertainty concerning the future.

If the programming and scheduling recommendations outlined earlier in this report are effected, then preliminary engineering workloads will be clearly defined for five years in advance.

The Soils and Foundation Section of the Bureau of Materials and Research works closely with the location and design units in order to facilitate line location and aid in the determination of geometric and structural design criteria. The section also handles soil problems for the Bureau of Construction, occasionally does work for the Right-of-Way Division and furnishes soils information to consultants employed by the Bureau of Design. Consultants are not used to do soils or foundation work, with the exception of complex and specialized work such as the Harbor Tunnel and the Bay Bridge.

SOILS AND FOUNDATION INVESTIGATIONS

Communication between the Soils and Foundation Section and other highway units generally is good and soils recommendations usually are followed. Occasionally, lead time is insufficient for a thorough soils investigation before final completion of plans.

The only real significance of the situations discussed above is that the preliminary engineering activities are seriously handicapped by the lack of a firm program and work schedule.

Since 1958, when there was a substantial reorganization of the State Roads Commission's right-of-way acquisition function — to provide for an expanded federal-aid highway program and to carry out the intent of new legislation (1956) — this function has been the subject of several studies. These have included (1) the Green Commission

RIGHT-OF-WAY ACQUISITION

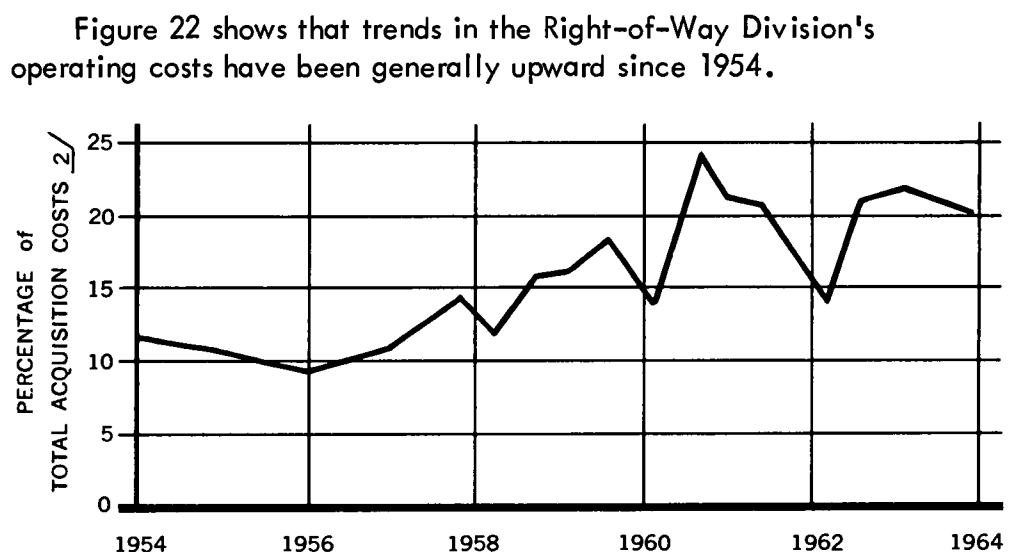
Study, ^{27/} a study conducted by a consultant ^{28/} and in-depth studies — still in progress — by the Maryland Division of the U. S. Bureau of Public Roads. Such studies have helped the Commission organize its right-of-way acquisition and property management function more efficiently.

Among the indications of progressive management in the present conduct of this function are the following:

1. Clear definitions of organization, responsibility and authority for the different organizational units — as set forth in Section 1 of the "Right of Way Administrative Manual," dated June 1, 1963. ^{29/}
2. Clear definitions of operating procedures as set forth in the "Right of Way Manual of Operations," dated January 1, 1964.
3. An effective training program for all right-of-way agents and other key personnel.
4. Compilation and periodic issuance of progress, status and control reports and records.

MEASURES OF PERFORMANCE

Figure 22
RIGHT-OF-WAY
DIVISION
OPERATING
COSTS
AS RELATED TO TOTAL
ACQUISITION COSTS ^{1/}



^{1/} Includes outside appraisal, outside legal assistance, boards of property review and total right-of-way acquisition costs.

^{2/} Excludes Legal Department operational costs.

Data: Right-of-Way Division, State Roads Commission.

^{27/} Improving Road Administration in Maryland, a report to the Governor of Maryland by the Commission on State Programs, Organization and Finance, November 15, 1955.

^{28/} A Report on Organization and Procedures of the State Roads Commission of Maryland, Highway Management Associates, August 1961.

^{29/} Other sections of this manual still are under development.

There are several explanations for these increased costs during a period of apparent declining workload. ^{30/} These include the following:

- 1. The U. S. Bureau of Public Roads has required an increasing amount of documentation and codification for right-of-way acquisitions on federal-aid projects.
- 2. The number of parcels taken do not reflect their size or the complexity of the taking. During the earlier years, more properties were acquired in rural areas, but in more recent years there have been more acquisitions in the highly urbanized areas.
- 3. The public's focus on state highway programs has necessitated greater emphasis on public relations and consideration of displaced property owners.

Additional indications of performance are revealed in Figure 23, which shows a comparison of negotiations and condemnations before and after passage of the 1956 Blanket Taking - Immediate Entry Law designed to reduce the number of court cases.

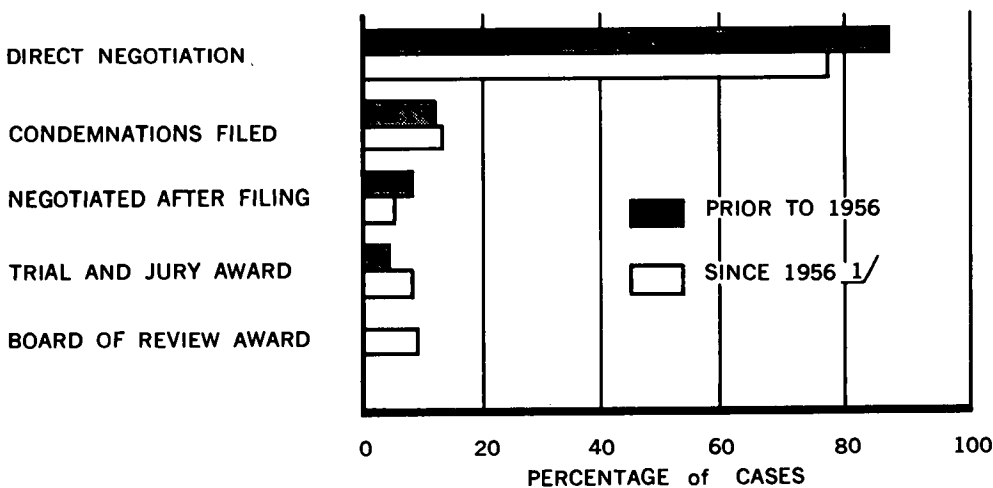


Figure 23
**RIGHT-OF-WAY
SETTLEMENT
HISTORY**
NEGOTIATION
VS.
CONDEMNATION

^{1/} To December 31, 1963.
Data: Notes on talk delivered before County Engineers Association, Baltimore, Maryland, May 1, 1964, by Chief, Right-of-Way Division.

It is important to recognize that since 1956 the Commission has been involved to a much greater degree in acquiring property for urban freeways with more complex and presumably more difficult taking problems. However, the percentage of right-of-way cases settled by

^{30/} The number of parcels obtained declined from 3,156 in 1954 to 1,242 in 1963.

direct negotiation has not materially decreased, particularly when consideration is given to the cases settled by Board of Property Review award.

The ability of the right-of-way organization to meet scheduled acquisition dates as established for the current construction program ordinarily would provide another indication of performance. These dates have not been met, but this may be attributed to inadequate lead time.

ADVANCE ACQUISITION

Purchase of right-of-way in advance of normal requirements for the current construction program is desirable for two reasons. First, there are hardship cases where owners must vacate their property but face a closed market because of the knowledge that the property eventually will be taken by the State. Second, there are properties where development is imminent and which will have to be bought at a much higher cost if not acquired currently.

Authorization for advance acquisition of right-of-way was provided under legislation in 1957, which created a two-million-dollar revolving fund for this purpose over the five-year period 1957-1962. This fund was used to finance advance acquisitions and was repaid from current program authorizations as advance purchases became a part of current projects. This authorization no longer is in effect. Expenditures from and reimbursements to the fund resulted in the following calendar year-end balances of commitments:

1957	\$ 526,500
1958	10,000
1959	1,768,000
1960	1,506,000
1961	1,516,000
1962	1,553,000
1963	1,292,000
Current	900,000 (approximate)

In 1964, legislation provided that "the Commission by resolution may authorize expenditures from bond issue proceeds and other funds available to the Commission during any fiscal year in an amount not to exceed the sum of two million dollars (\$2,000,000) for the purpose of acquiring rights-of-way for future State highway projects included in the official 'Needs Study' program of the Commission."

As of November 18, 1964, commitments against this fund totaled \$1,559,000. Of this, \$1,464,000 is for property in connection with projects in the current six-year program, presumably for projects in the last four years of the program. The balance of commitments, \$95,000, is for projects beyond the six-year program.

Evaluation of the foregoing leads to the following observations:

1. There apparently is no point in having a revolving fund for advance right-of-way purchases, since the monies come from the same source whether incorporated in a revolving fund or budgeted for expenditure in the same manner as other right-of-way purchases. The present advance purchasing does not involve a revolving fund.
2. Most advance purchasing at this time is in the six-year program, only \$95,000 involving projects beyond this period. This may be indicative of uncertainty with regard to projects in the needs study program, or it may be indicative of the need to utilize these funds in the purchase of right-of-way for projects in the six-year program.
3. It appears that advance purchases of right-of-way can continue to be financed as they presently are. If larger authorizations can be demonstrated to be needed, the budgeted amounts should be increased accordingly.

The following conclusions have been drawn regarding operations of the Right-of-Way Division:

CONCLUSIONS

- There are clear definitions of organization, responsibility, authority and procedures, as well as a strong training program.
- Ability to meet scheduled dates represents the major problem. Programming and scheduling recommendations discussed elsewhere in this report should remedy this.
- Advance acquisition is desirable and can be accomplished under current legislative provisions. If increased amounts of funds are demonstrated to be needed, financing should be included in the Commission's budget.

Operations

Included under the broad heading of operations are the supervision and administration of construction, the testing and control of materials, the management and conduct of maintenance, and traffic engineering. The research function also is included due to its present placement in the organization.

All of these functions currently are carried on under the general supervision of the Chief Engineer, with specific responsibilities divided among the seven District Engineers and the Assistant Chief Engineers for Construction, Materials and Research, Maintenance and Operations, and Traffic.

The District Engineers are specifically delegated responsibility for construction projects within their districts. They exercise authority over construction and other personnel assigned to these projects even though such persons — including project engineers and construction inspectors — are administratively assigned to state-level organizational units.

With the exception of the District Engineer and his Assistant District Engineer for Construction, all personnel on the payroll in each district may be considered to be devoted to the maintenance and operation of existing highways.

Significant facts, conclusions and recommendations drawn from the review of the operations functions are presented in the sections which follow.

CONSTRUCTION

The Bureau of Construction forms a major subdivision of the Engineering Division and is administered by the Assistant Chief Engineer for Construction. It is composed of the Bureau of Construction Inspection, the Construction Contracts Section and the Construction Controls Section. These units work closely with the District Engineers to achieve efficient use of inspection personnel, proper enforcement of specifications and uniformity in standard procedures.

SPECIFICATIONS AND PROCEDURES

During the past two years, major effort has been devoted to streamlining construction administration, providing personnel with additional guidance in construction practices and procedures, and updating construction specifications:

1. A manual entitled "Construction Items by Category and Code" was published in 1964 to standardize nomenclature and abbreviations, minimize the number of bid items, provide a basis

for data retrieval using computers and provide categories for making cost estimates and recording progress.

2. A manual of written instructions for construction personnel — to be used as a supplement to standard specifications and contract documents — has been partially completed. Completed portions have been distributed and are in use. ^{31/}
3. Construction specifications currently are being reviewed, revised and incorporated in an updated edition of the specifications manual. ^{32/}

These efforts represent significant accomplishments. Completion of those items still in progress should be expedited. Provision also should be made for periodic review and updating of these manuals.

Since 1957, the consideration of a bid proposal by the Commission has been contingent upon the prequalification rating and work-type classification of the contractor.

PREQUALIFICATION OF CONTRACTORS

The prequalification rating is an expression of the upper monetary value of work which the contractor can perform. It is based on analysis of the contractor's financial condition and rating of his performance. The basic dollar factor used in computing the final rating is the contractor's working capital as determined by Commission personnel.

A rating of 7-1/2 times the working capital plus two times the book value of his equipment is automatically assigned to each contractor.

In the final rating, a contractor with experience in Maryland may be allowed up to an additional five times his working capital based on his past performance.

During fiscal year 1963, 177 contractors with Maryland experience were rated on this five-point scale. None was given a rating of less than three and 75 per cent were given ratings greater than four. An additional credit of two times the book value of rented highway construction equipment may be received under specified conditions.

The tight grouping of all contractors at the upper end of the performance scale has the effect of devaluating actual differences in performance, and results in ratings which are largely a reflection of

^{31/} "Construction Manual," Bureau of Construction, State Roads Commission, 1963 (Parts I, V, VII and XII).

^{32/} "Specifications for Materials, Highways, Bridges and Incidental Structures," State Roads Commission, January 1962.

financial condition. There is no minimum performance rating established which would automatically disqualify a contractor on his past performance. The Commission may, however, revoke or deny a Certificate of Prequalification if the performance record and operating personnel of the contractor are not satisfactory, or for other reasons at the Commission's discretion.

It appears that the prequalification procedure should be altered to give more consideration to actual performance.

SIZE OF CONTRACTS

The size of construction contracts affects the performance of any highway organization. For example, if contracts are too small, costs may be higher on a unit basis. If contracts are too large, the number of contractors who can bid may be restricted.

A comparison of the dollar size of contracts let by the Commission in fiscal year 1963 with nationwide average contract sizes revealed that Maryland contracts were generally larger, as follows:

1. Nationwide, 42 per cent of the federal-state highway and bridge construction contract awards made during the first six months of 1964 were for amounts less than \$100,000 and 74 per cent were for less than \$500,000. Awards averaged about \$571,000, with the median size about \$158,000. ^{33/}
2. In Maryland, 28 per cent of the contract awards were for less than \$100,000, and 66 per cent were for less than \$500,000. The average contract award was \$616,268, with the median about \$260,000.

DELAYS

Review of construction progress reports for fiscal years 1961 through 1964 indicates that an average of 54 per cent of the construction contracts in progress during this period were affected by delays. These delays, grouped by cause, are shown in Figure 24. The data indicate that:

1. Utilities and right-of-way acquisition have been the major causes of delays.
2. Since 1962, the percentage of projects delayed has been progressively reduced — from 67 per cent in 1962 to 45 per cent in 1964.

Utility operations are independent of Commission operations and the utilities schedule relocation work at their convenience. They will

^{33/}NHUC Reports, bulletin dated October 23, 1964, National Highway Users Conference.

not relocate until all of the right-of-way affecting utilities has been acquired. Thus, if a property settlement has not been made, a construction delay may be attributed to both right-of-way and utilities.

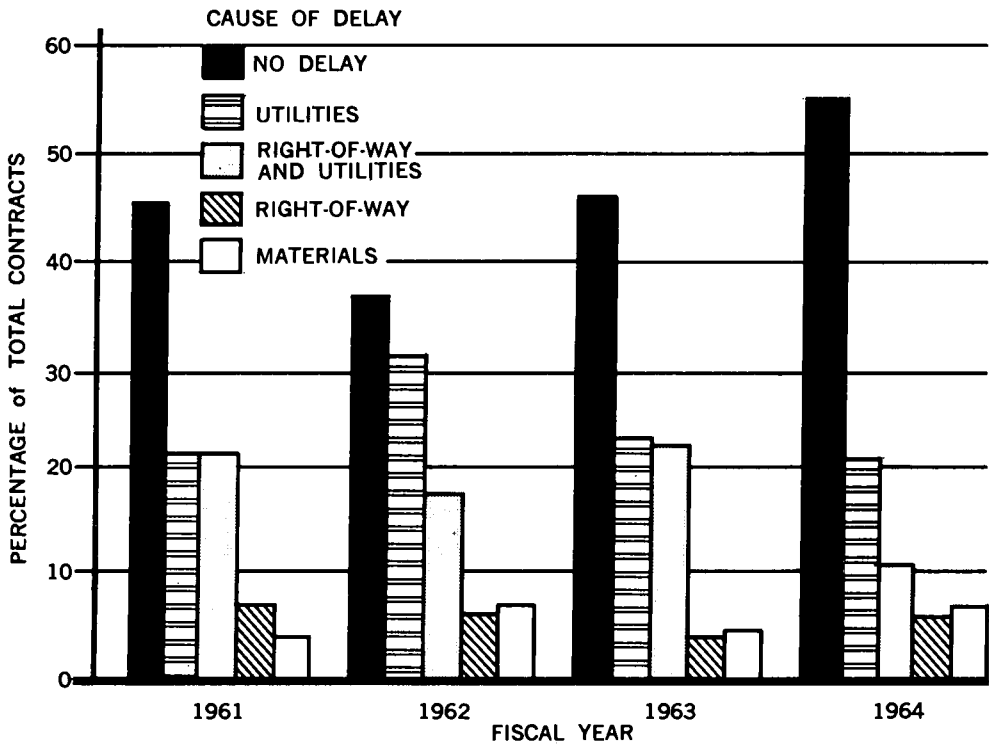


Figure 24
PROJECT DELAYS
IN
CONSTRUCTION

Data: Construction Progress Reports, June 1961 through June 1964, State Roads Commission.

Materials delays are not necessarily delays in materials testing, but may be the result of difficulty experienced in locating a source of or purchasing materials.

It appears that provisions for ample lead time would greatly improve performance in these areas. Such provisions would ensure that the right-of-way is cleared prior to the scheduled start of utility removal or relocation. This would permit utilities in turn to better schedule their work and to comply with the required sequence of construction without causing delays. In addition, adequate lead time — as reflected by a relatively firm program — would reduce materials delays through better planning of materials production and distribution.

A sampling of construction projects completed between September 9, 1961, and August 21, 1964, revealed that of the 120 contracts sampled, 37 projects — or 31 per cent — were overrun for a net of 2,137 project days. Extensions were granted on 35 of the overrun projects. These extensions totaled 1,940 project days. Liquidated damages — penalties for failure to meet the contracted completion dates — were assessed on nine of the overrun contracts.

CONTRACT
OVERRUNS

In light of other problems noted — such as delays, lack of sufficient lead time and, perhaps, prequalification methods — it is difficult to assess the meaning of these data in terms of present policies and procedures for granting extensions or assessing liquidated damages. However, the apparent number of overruns suggests the need for further study in this area.

FINAL PAYMENTS TO CONTRACTORS

The same project sample described above was reviewed to determine elapsed time from acceptance for maintenance to receipt of final payment by contractors. Elapsed time varied between 48 and 678 days, and generally the larger the contract the longer the time required to process final payment. Contracts covering less than 50 working days required an average of 111 days, or nearly four months. Those covering more than 250 working days required an average of 212 days, or about seven months. In one case, however, a project covering 15 working days required 220 days for processing of final payment, and in another, final payment for a project covering 632 working days was made 89 days after acceptance for maintenance.

Any one of several processing steps can substantially delay final payment — materials clearance, quantity measurements, processing of extra-work authorizations, contract extensions, liquidated damage assessments, resolution of claims and final audit and approval.

It appears that some extremely long time periods have elapsed between work completion and final payment to the contractor and that a work simplification type analysis of the various processing steps involved should be considered.

MATERIALS QUALITY CONTROL

Review of the materials testing function in the Bureau of Materials and Research showed that the number of samples processed has increased 300 per cent in eight years — from 16,316 samples in 1957 to an anticipated 49,000 samples at the end of 1964. The number of personnel in this Bureau increased more than 400 per cent — from 76 in 1957 to an expected 409 in 1965.

While the total number of personnel engaged in materials testing and control activities has grown faster than the number of samples processed, productivity in the testing function itself actually has increased. A comparison of the number of samples processed with persons engaged in the actual testing of materials (Figure 25) shows that in 1960 an average of 280 samples were processed per man, while in 1963 an average of 425 samples were processed per man. By the end of 1964, the average is expected to reach 485.

Recent and current efforts to improve construction control of materials include:

1. Reorganization of the materials testing processes and construction of modern testing facilities.
2. Decentralization of testing facilities to each of four regions — three of which are now in operation.
3. Establishment of a state-wide Control Unit to ensure control of conditions, processes and materials; to coordinate testing activities; to train men; and to provide advice and assistance as needed.
4. Development of a sampling frequency chart as a guide to the number of samples to be taken to establish and maintain quality control.
5. Preparation of a "Materials Testing Manual" containing testing procedures of the Commission.
6. Revision of materials specifications to encompass continually developing research findings.

The above efforts represent significant accomplishments directed toward increasing efficiency and general improvement of the materials function.

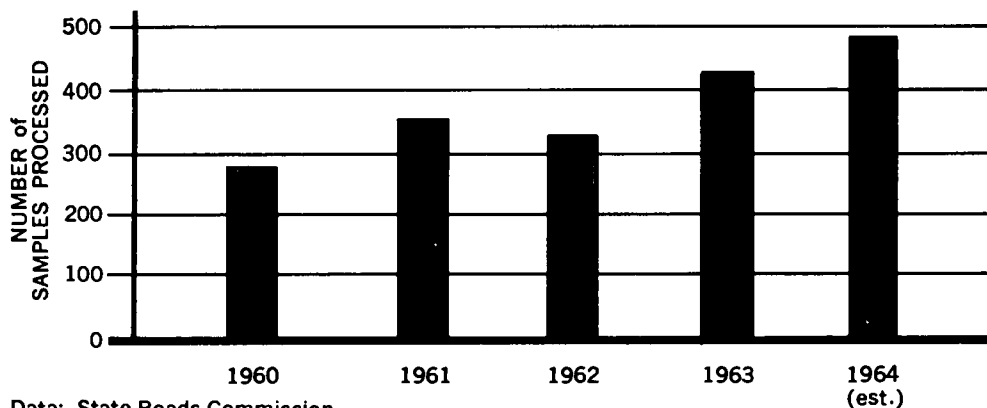


Figure 25
SAMPLES
PROCESSED PER
TESTING
EMPLOYEE

Recommendation. Initiate a series of internal studies directed toward improvement of prequalification procedures and final payment processes, and reduction of contract overruns.

Conduct of such studies would be appropriate activity for the Bureau of Organization and Management of the Administrative Division, if this unit were properly staffed.

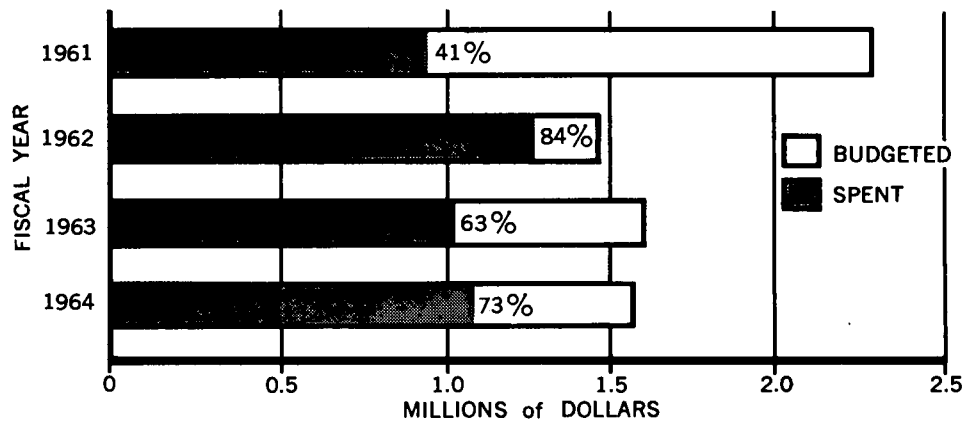
Research is conducted by the Commission within various organizational units and by universities and consultants. The research budget is

RESEARCH

financed through federal highway planning survey (HPS) and highway planning and research (HPR) funds and matching state monies.

The data in Figure 26 show planning and research funds budgeted and spent for fiscal years 1961 through 1964. Funds budgeted ranged from about 1.5 million dollars to nearly 2.3 million dollars — averaging 1.7 million dollars annually. Actual expenditures averaged about 1.1 million dollars annually — 65 per cent of the budgeted funds.

Figure 26
**PLANNING AND
RESEARCH FUNDS**
FEDERAL-AID AND
STATE MATCHING



Data: State Roads Commission.

In 1961, the Bureau of Materials and Research was assigned responsibility for the coordination of all Commission research activities. However, specific research to be conducted is determined annually through a general canvassing of the Commission's various organizational units by a bureau chief in the Planning and Programming Division. Studies remaining or overlapping from the previous fiscal year plus new studies desired are incorporated into a proposed work program, which, when approved by the Commission, is submitted to the U. S. Bureau of Public Roads for approval. Upon approval, this program becomes the basic research plan of the Commission.

As an essential aid to the research effort, a general library is maintained in the Commission headquarters building in Baltimore and a technical library is maintained in the Central Laboratory building of the Bureau of Materials and Research.

In 1959, when the Commission authorized the establishment of a Planning and Programming Division, a research responsibility was given the division but without specific definition of its purpose and scope. The later assignment of responsibility to the Bureau of Materials and Research — combined with continued deep involvement of the Planning and Programming Division in drawing together plans for research — has left the placement of actual responsibility unclear.

The foregoing factors indicate that:

1. Full utilization of budgeted research funds is not being made.

2. Responsibility for research activities is not clearly defined.

Recommendation. Establish responsibility for selection of research projects and coordination of all research efforts in a Research Committee — and expand and more clearly define areas in which research is to be conducted.

A Research Committee composed of the Chief Engineers for Development and Operations, the Chief, Office of Finance and the Chief, Office of Administration and chaired by the Deputy Director of Highways would ensure representation of all pertinent considerations in the selection of research projects, assignment of specific research responsibilities and evaluation of results attained .^{34/}

Responsibility for areas in which continuing research is required should be delegated to standing subcommittees composed of appropriate staff and operating personnel. Such subcommittees could be designated to conduct continuing research in geometric design standards, material standards and specifications, equipment and operations, and similar areas.

Administration, monitoring, day-to-day coordination, assembly of progress reports, evaluation and communication of research results and maintenance of research records and the technical library could remain, as currently assigned, with the materials and research organization.

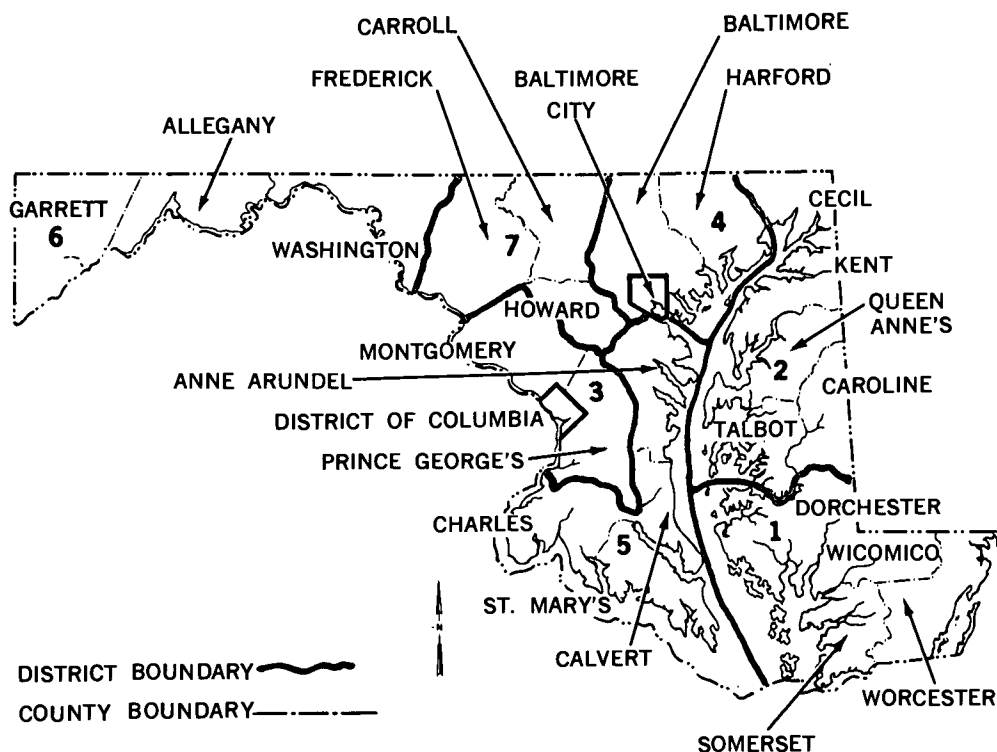
Maintenance activities may be divided into two categories: (1) physical and general maintenance, and (2) traffic service. Physical and general maintenance includes work involved in keeping highway surfaces, shoulders, drainage facilities and bridges in good condition. Traffic service includes those functions necessary to facilitate traffic movements — such as snow and ice control, signs, signals, centerline stripes and other pavement markings, and lighting.

MAINTENANCE

Most maintenance on Maryland's state highways is performed by state forces. Routine physical maintenance and traffic service activities such as patching and snow removal are accomplished by the personnel of the seven operating districts. As of the end of fiscal year 1964, there were an average of 250 personnel and 163 pieces of construction and maintenance equipment in each of the seven districts. The district boundaries are shown in Figure 27.

^{34/} See Figure 33 in the organization section of this report for position titles listed.

Figure 27
**HIGHWAY
 DISTRICTS**
 MARYLAND STATE
 ROADS COMMISSION



Operations such as bridge repair, design and supervision of landscaping activities, and centerline marking are performed by state-level crews under the Bureau of Operations. Contractors are used to assist in some of these specialized functions, to perform major resurfacing projects and to supplement district personnel and equipment in snow-removal operations as required.

PATTERNS OF OPERATION

To obtain indications of operating patterns, the overall maintenance expenditure and personnel data noted in Part One of this report were further refined. Relationships between basic measures of workload, staffing, equipment distribution and expenditure were developed and compared by district.

Figure 28 shows comparisons between districts with respect to staffing and equipment distribution as of the end of fiscal year 1964. Employees per piece of equipment varied by 67 per cent, road surface area per piece of equipment by 75 per cent, road surface area per employee by 54 per cent and, perhaps most significant of all, wage personnel and motor equipment operators per road foreman by 129 per cent.

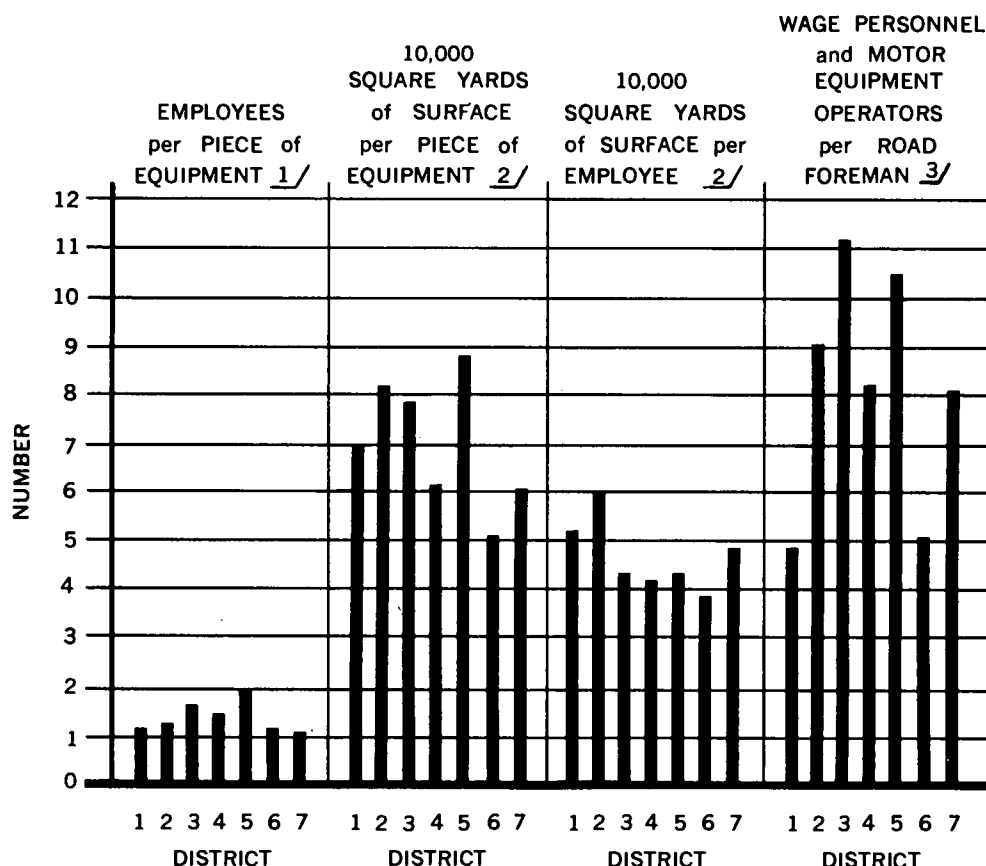


Figure 28

MAINTENANCE STAFFING AND EQUIPMENT PATTERNS

BY DISTRICT

1/ Pieces of construction and maintenance equipment. Does not include automobiles.

2/ Includes state-maintained county roads in Districts 2 and 5. Number of employees as of June 30, 1964.

3/ Positions budgeted as of September 1964.

Data: Bureaus of Maintenance and Personnel, State Roads Commission.

Figure 29 provides a comparison of maintenance expenditures between districts for fiscal year 1964. District expenditures per unit area of state road surface varied 70 per cent in physical and general maintenance, 137 per cent in traffic service, 97 per cent in other expenditures — primarily composed of administrative and general expense — and 99 per cent in total. Total district maintenance expenditures per employee also showed a wide variation, with a total spread of \$3,977 between the highest and lowest figures — a difference of 67 per cent.

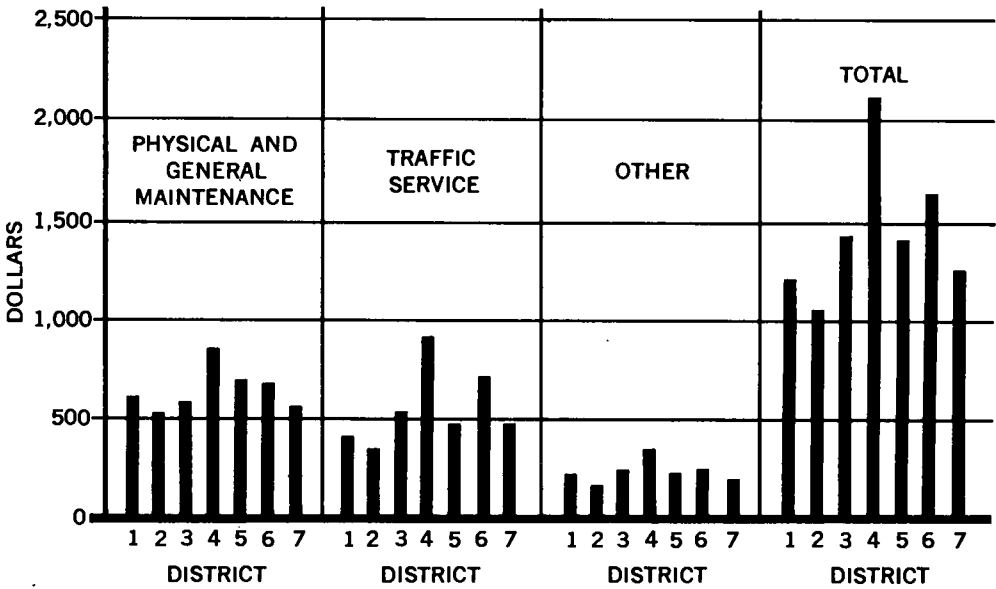
Some variations rightfully may be expected in ratios such as these. The ratios themselves are, however, related to cost and performance factors and analysis of such data may well provide a base for improving effectiveness.

For example, Districts 3 and 4 are similar in that operations in both are influenced by large urban populations. In each case, the urban area itself is not a part of the districts' operating responsibility — Washington

STATE MAINTENANCE FUND
EXPENDITURES per
10,000 SQUARE YARDS of
STATE HIGHWAY SURFACE

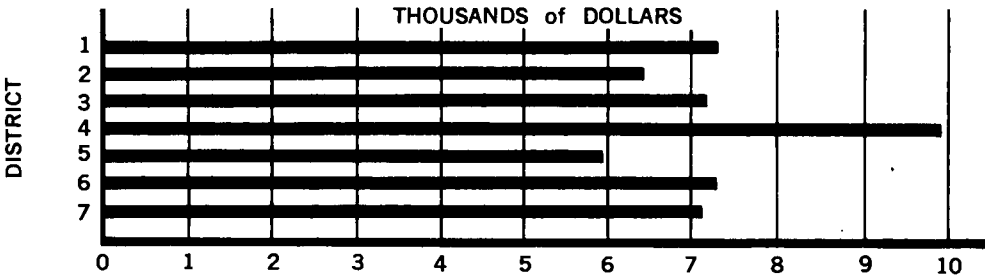
Figure 29
MAINTENANCE
EXPENDITURE
RATIOS BY
DISTRICT

FISCAL YEAR 1964



^{1/} Includes County Maintenance Funds in Districts 2 and 5. Employees as of end of fiscal year.
Data: Bureau of Maintenance and Finance and Accounting Division, State Roads Commission.

TOTAL DISTRICT
MAINTENANCE
EXPENDITURES per
DISTRICT EMPLOYEE ^{1/}



and Baltimore City each maintain their own roads and streets. Another point of similarity is that road surface area maintained per employee was nearly equal in 1964 — 44,000 square yards in District 3 and 42,000 in District 4.

On the other hand, analysis of other staffing and equipment patterns might well raise such questions as, "Why is there a 28 per cent difference in the number of pieces of equipment per unit of surface area maintained in these two districts?" Or, "Why does District 3 assign 11.2 persons per road foreman while District 4 assigns 8.3 persons per road foreman?" Or, "Why does it require \$2,128 to maintain 10,000 square yards of surface in District 4 and \$1,462 in District 3?"

To take two other similar districts as examples, it might be asked "Why are expenditures for physical and general maintenance (per 10,000 square yards of surface maintained) \$105 less in District 2 than in District 1?" Or, "Why are there only 4.9 employees assigned per road foreman in District 1 and 9.1 in District 2?"

Such ratios as those shown above are not meaningful in and of themselves for the reason that there do not exist established standards against which to measure them. For example, one district might perform its mowing operations in an extremely efficient manner insofar as its

methods are concerned. However, it might mow its areas more frequently than necessary to achieve a desired level of maintenance. Consequently, its mowing costs may exceed those of another unit in which mowing operations are less efficient but in which mowing is performed less frequently. Because there do not exist standards — as to methods, levels of maintenance, costs or time — the above data do not necessarily indicate effectiveness of performance in the districts.

Even though these data cannot be conclusively interpreted — because of the lack of adequate measures of workload or performance standards — they do lead to one conclusion: the variations are of such magnitude that they indicate significant differences in operating patterns and methods from one district to another. This strongly suggests that differences in levels of maintenance, efficiency and productivity also exist — and that research directed to the establishment of uniform standards, methods and procedures would result in improved performance.

The observed variations in expenditures among districts appear to indicate that funds have been allocated on the basis of differing needs from district to district. In practice, however, funds allocated to districts have been in accordance with empirical formulas — and judgment based on past expenditures. Funds for physical and general maintenance are allocated to districts on the basis of a formula which accords 25 per cent weight to vehicle-miles of travel and 75 per cent weight to road surface area maintained. Funds for traffic services have been allocated in accordance with separate needs formulas.

ALLOCATION OF FUNDS AND DEVELOPMENT OF PROGRAMS

Amounts designated for expenditure on specific state-wide programs such as resurfacing and bridge maintenance and repair also have not been based on determination of needs. The annual programs of specific projects to be performed have been made to fit funds available. This is particularly true in the case of bridge maintenance and repair, where the specific projects have been defined only after the total allocated for this purpose has been fixed.

In the case of resurfacing, programs have been developed from recommendations submitted by district personnel. These have been reviewed in the Central Office, and projects have been arranged in a state-wide priority listing. The amount of money allocated has then determined how much of this program would be built.^{35/}

A portion of the funds allocated for this purpose during the current fiscal year is dependent on the severity of the winter and the resulting cost of snow removal. The wide variance of snow-removal costs from

^{35/}Resurfacing needs currently are being projected for five years in advance for the first time. How this will affect future fund allocations is not yet known.

year to year has increased with the continuing growth in mileage designed for "bare pavement maintenance."^{36/} This has now become such a sizeable expenditure that to a significant degree the amounts available for resurfacing — and normal physical maintenance — are uncertain until after the winter season.

In the case of equipment procurement and replacement, on the other hand, a specific program based on district estimates of needs has been the basis for amounts budgeted and submitted to the General Assembly for approval. This portion of the State Maintenance Fund appropriation, however, also covers acquisition of capital properties for other Commission units and purposes — including passenger cars, land and buildings and office, engineering, testing, research and experimental equipment — as well as for capital items directly related to maintenance and operations.

MAINTENANCE NEEDS

There are strong indications that maintenance needs are generally greater than can be satisfied with amounts presently allocated. A report dealing with maintenance needs was prepared as a part of the state highway needs study in 1963.^{37/} This report concluded that "even at this level of expenditures, highway maintenance on the State system is far less than desirable."^{38/} Other conclusions were:

1. There is \$8,000,000 worth of bituminous overlay work which needs to be done immediately.
2. Large expressways — like the Baltimore Beltway and the Baltimore-Harrisburg Expressway and others — will require annual expenditures of at least \$15,000 per mile properly to maintain them.
3. Some roads are in critical condition and will be subject to severe stress during another winter.

Although the means used to arrive at these conclusions are not explained in detail, the report does indicate (1) that maintenance needs have increased at a faster rate than they have been satisfied and (2) there will be required considerably greater expenditures for maintenance in the future.

^{36/} Bare-pavement maintenance methods attempt to prevent accumulation of snow and ice, primarily through extensive use of chemicals. They are considerably more expensive than those which concentrate on removal after accumulation. Lane-mileage designated has nearly doubled in the last eight years — from approximately 3,410 miles in 1957 to 6,411 for the current fiscal year.

^{37/} A Preliminary Report — Highway Maintenance in Maryland, State Roads Commission of Maryland (1963).

^{38/} Ibid. The statement referred to the \$13,200,000 budgeted for maintenance of state highways during fiscal year 1964.

During fiscal year 1964, the State Maintenance Fund and state-administered County Maintenance Funds in six counties accounted for major portions of certain basic Commission expenditures. In comparison to total expenditures, these funds accounted for:

1. 30 per cent of the wages and salaries.
2. 50 per cent of the materials and supplies.
3. 88 per cent of the equipment service costs.
4. 93 per cent of the equipment rentals for direct roadwork.

Because of the size of these expenditures, their basically direct and controllable nature, and the fundamental importance of protecting the public safety and investment, the management of maintenance functions has a substantial effect on overall Commission performance.

The great bulk of the management, engineering and administrative control of maintenance activities is performed by a Central Office staff of 21 persons — including engineers, engineering associates, equipment control officers, clerks, secretaries and stenographers.^{39/} In addition, eight employees of the Landscape and Special Operations Sections are management and technical personnel. If appropriate district personnel also are considered, a total of 125 persons ^{40/} are budgeted to engage in the management, engineering and general administration of maintenance functions. Considering the 16 million dollars budgeted for maintenance during fiscal 1965 — including both state and state-administered county maintenance funds — there is one such employee for each \$128,000 to be spent.

In contrast, personnel engaged primarily in planning, design, technical control and general administration of construction number nearly 1,400 — one for each \$57,000 budgeted. While some of these personnel provide assistance and information to maintenance managers, their duties are primarily related to construction.

The point of the above analysis is that there is considerably less expended for planning, engineering and general administration of maintenance activities than for construction. This fact is particularly significant when it is considered that maintenance is, in many respects, considerably more complex than construction — and certainly is subject to more specific management direction and control by Commission forces than is contract construction.

^{39/} Total budgeted for Office of Highway Maintenance and Operations, Bureau of Maintenance and Bureau of Operations as of September 22, 1964.

^{40/} Excludes Assistant District Engineers for Construction, Highway Maintenance Supervisors, Road Foremen, Shop Foremen, Clerks, Motor Equipment Operators, Mechanics, other salaried operations personnel and all district wage personnel.

There is no established rule by which the significance of the above difference can be evaluated — nor is there any definite basis for asserting that such a difference should not exist. In the review of the maintenance activities during the course of this study, however, the following observations have been made:

1. There are significant variations in staffing, equipment and expenditure patterns in districts — indicating significant differences in standards, methods and productivity.
2. The satisfaction of specific maintenance needs has not been the primary basis for allocation of maintenance funds. Consequently, expenditures in the past have not been directed specifically to the accomplishment of a consistent level of service.
3. Maintenance requirements and costs are influenced by a great many factors — weather, traffic volume, public demand for increased services, increasing size of the system and others. Consequently, past expenditures are not a reliable guide to future expenditures.

These facts strongly suggest the need for the development of improved techniques and skills in planning, directing, scheduling and controlling maintenance operations — the accomplishment of which probably will require more staff personnel.

The analyses presented in the preceding sections provides bases for the following recommendation:

Recommendation. Conduct a thorough research evaluation of maintenance planning, scheduling, operations, reporting and control procedures — to provide a basis for developing such modifications or innovations as will assist top management, the maintenance staff and field supervisors in attaining high-quality maintenance with economy.

The questions associated with maintenance in all public highway agencies are pretty much the same:

- How to organize an efficient operation with the limitations imposed by its being a non-competitive, non-profit government activity?

- ▶ How to plan, schedule and supervise work over a huge area — with greatly varying conditions?
- ▶ How to provide the optimum in service to highway users within reasonable economic limits of cost?
- ▶ How to establish performance standards for recurring work items?
- ▶ How to establish basic manpower and equipment requirements?
- ▶ How to maintain uniformity in quality of work?
- ▶ How to measure and control maintenance performance?
- ▶ How to recruit and develop field personnel?

Answering such questions as these are important decisions for top management of the Commission. The data presented in the preceding sections represent only the beginning of analysis in any of these areas, but they do illustrate some of the relationships and evaluations involved in answering the many questions associated with the planning, direction and control of maintenance. The data in Figures 28 and 29 do not give answers, but do illustrate the need to establish why such variations exist and the degree to which they should exist. Research should result in the development of bases for establishing realistic manpower and equipment quotas related to varying conditions in districts, as well as determination of most effective methods and procedures, desirable levels of service, and improved means for scheduling and controlling maintenance work.

It has been said in regard to the highway maintenance activity nationally that it provides greater potential for dollar savings from management improvement than does any other activity of highway departments. If the Commission initiates the type of maintenance research here recommended, it will be one of the early pioneers in the effort to make maintenance planning and control a scientific management operation.

The essential elements of a research project in maintenance are outlined below:

1. Analysis of records to determine trends in maintenance functions and to get general measures of workload.
2. Collection of current operating data from selected field units for a full one-year cycle — data to be reported in terms of units of measurement established as the result of analysis in the previous step.

3. Thorough review of the existing organization — its system of reporting, procedures for planning and scheduling work, and utilization of manpower, materials and equipment — and the development of modifications where desirable.
4. Analysis of individual maintenance work items by pilot production studies — directed to the development of best methods and procedures for performing work.

The result should be the development of procedures, based on research for (1) developing and using performance standards for planning and controlling maintenance activities, (2) planning and scheduling maintenance work, and (3) reporting and controlling maintenance operations.

TRAFFIC ENGINEERING

Traffic engineering involves activities concerned with the safe and efficient direction, control and guidance of traffic movements on the State Highway System. This function is accomplished through adoption of traffic regulatory measures and application of uniform traffic control devices and other traffic aids resulting from engineering studies.

A review of Maryland's highway and motor vehicle laws indicates that the Commission has ample authority and power to adopt traffic regulatory measures and to carry out a comprehensive traffic engineering program.

Within the Commission, the basic responsibility for traffic engineering is vested in the Bureau of Traffic in the Engineering Division. This bureau conducts investigations — from the Central Office of the Commission — of those problem areas brought to the attention of the Commission. It also conducts a large variety of traffic studies, the majority of which are closely related to the gathering of trip and traffic data for highway planning purposes.

Short volume counts are taken to develop traffic flow diagrams and to determine warrants for traffic control signal installations. Some motor vehicle spot speed studies and travel time and distance studies are made on special request. The bureau also is responsible for preferential routings, issuance of oversize and overweight permits, enforcement of size and weight regulations, loadometer surveys and highway sign manufacturing.

FACTUAL STUDIES

Study of the present distribution and number of Bureau of Traffic personnel indicates that only four persons — three of whom are technicians — are engaged in investigation of problem areas and studies for remedial action. This is less than four per cent of the total personnel complement. However, personnel of the traffic planning and truck

weight enforcement units are utilized for specific studies, such as loadometer surveys, when necessary. This personnel limitation generally has confined traffic investigations and studies to those for which formal complaints have been received.

Consequently, several major activity and study areas, normally engaged in by state highway traffic engineering units, are not given adequate attention. These include state-wide speed studies; high-accident-frequency location studies; continuous surveillance of the entire State Highway System to ensure adequacy of signing, markings, signal timing, sightlines and channelization; and other traffic engineering functions.

Copies of general accident data are furnished by the Central Accident Records Division of the Department of State Police. From these data, accident studies are made on a request basis — usually in conjunction with a specific study or problem area. A review of the source data at the Central Accident Records Division indicated that all pertinent accident data are available from which extensive accident research could be accomplished.^{41/}

Statutory enactments establish separate maximum lawful speed limits on various classes of roads. The Commission is authorized to establish lower limits if engineering and traffic investigations so warrant. However, the Commission cannot establish higher limits — even though an engineering and traffic investigation indicates that this would be reasonable and safe. SPEED LIMITS

Statutes also require lower speed limits for specific commercial vehicles in areas where the maximum lawful speed limit is greater than 35 miles per hour.

These factors indicate that speed limit ceilings and a differential speed limit between passenger cars and trucks have been established by legislative action rather than on the basis of engineering study, investigation or research.

There have been numerous studies made of vehicle speeds and speed zoning by federal, state and local agencies. A conclusion has been that drivers, in general, do not drive according to posted speed limits but rather at a speed that they consider proper, reasonable and safe for con-

^{41/} The Bureau of Traffic is engaged in a cooperative research project with the U. S. Bureau of Public Roads in relation to a "before and after" type accident study of the Interstate System.

ditions prevalent. Consequently, many state and local traffic agencies have established speed zones on the basis of the 85th percentile speed as determined from a representative sample taken in the area to be zoned. This type of zoning places enforcement on a more practical and reasonable basis and has the inherent characteristic of taking into account — through the average driver — roadway characteristics, existing traffic and roadway conditions, and roadside development.

A system of blanket speed limits imposed by statute may be the easiest control to install; however, it is contrary to the methods used to determine warrants for other types of regulatory and control devices and places an unnecessary burden on both drivers and enforcement agencies.

Recommendation. Establish speed limits on the basis of engineering investigation and evaluation — and require a systematic engineering review of all posted limits on a regular basis.

Implementation of this recommendation will require changes in the motor vehicle laws and initiation of state-wide speed studies — on a continuous basis — before all highways, roads and streets can be properly zoned and posted.

REGULATORY MEASURES

A "Maryland Manual of Traffic Control Devices" was developed and issued in 1955 in conformance with the 1948 American Association of State Highway Officials (AASHO) "Manual of Uniform Traffic Control Devices for Streets and Highways." The AASHO manual was revised and reissued in 1961, but the Maryland manual has not been subsequently revised. There is a nationwide effort to establish uniformity in traffic control devices and the U. S. Bureau of Public Roads has established the requirement that, by 1968, all devices on federal-aid routes conform to the AASHO manual.

The Commission currently is considering a contract for inventory of all existing traffic control devices — including signs, signals and highway markings. This inventory will be limited to the Federal-aid Primary System and all other highways or streets carrying an average daily traffic of 5,000 vehicles per day or more — involving about 2,000 miles of rural and urban highways.

Presently, all recommendations for traffic regulatory measures are submitted through the Chief Engineer to the Commission body for approval. Approved measures are communicated to the units concerned by the Commission Secretary. Receipt of this communication initiates the field work required — installation of signs, signals or markings.

There is no formal provision for notification of the Bureau of Traffic as to initiation or completion of field work performed by district forces.

Recommendation. Update the Maryland manual to conform with the current American Association of State Highway Officials "Manual on Uniform Traffic Control Devices for Streets and Highways."

Recommendation. Require all counties and municipalities of the State to conform to the standards and warrants set forth in the updated "Maryland Manual on Traffic Control Devices." Grant authority to the Commission to remove traffic control devices — on any public highway, road or street — not in conformation with the Maryland manual and to charge the cost of such removal to the county or municipality concerned.

Recommendation. Extend the current proposal for inventory of traffic control devices to include all highways, roads and streets under the jurisdiction of the Commission.

A review of the 1964 Annual Traffic Inventory Analysis compiled by the National Safety Council indicated that, based on 1963 data furnished by the State, Maryland fulfilled 87 per cent of currently recommended performance.

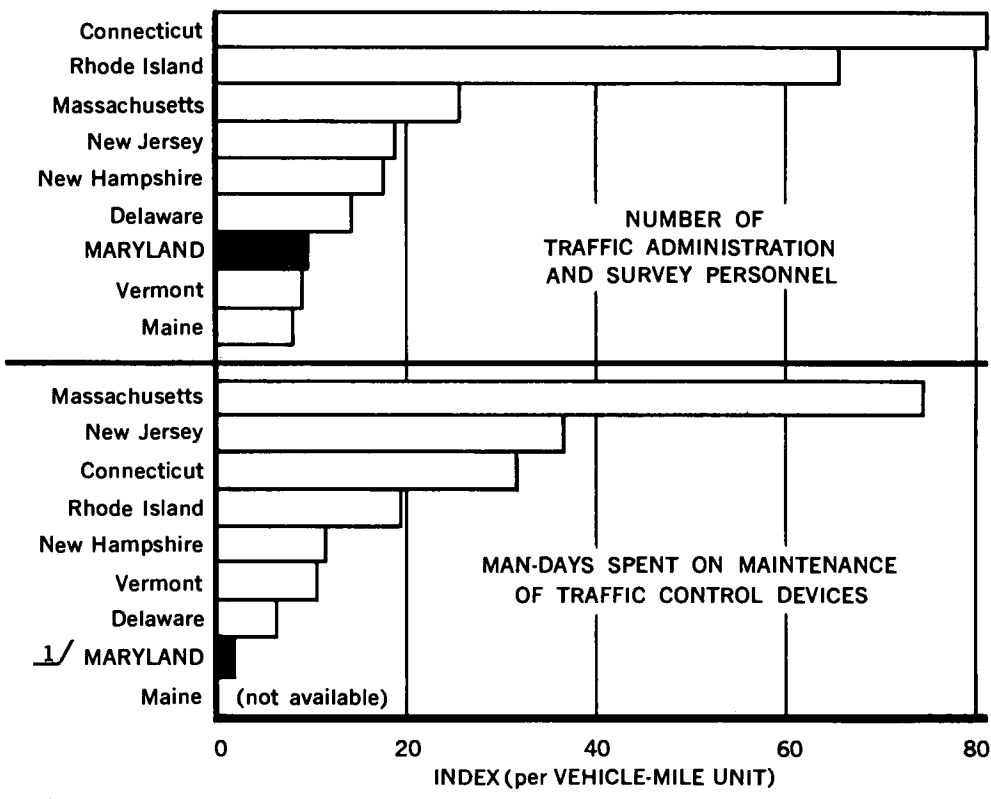
COMPARISON WITH OTHER STATES

Pertinent items pointed out in the report included the lack of a method requiring local jurisdictions to comply with law to follow standards and warrants as outlined in the "Maryland Manual of Traffic Control Devices," and the lack of a planned program for promotion of this manual with local jurisdictions.

The report also provided a comparison of the Commission's traffic engineering activities for the year 1963 with eight other eastern states.

Figure 30 shows that Maryland's staff for traffic administration, surveys and planning studies ranked seventh on a vehicle-mile unit basis — exceeding only Vermont and Maine. On the basis of the total number of personnel employed, Maryland ranked third. The number of man-days spent on maintenance of traffic control devices in Maryland was the lowest of the eight states. This same relative position was maintained when expressed as man-days per vehicle-mile or per system mile.

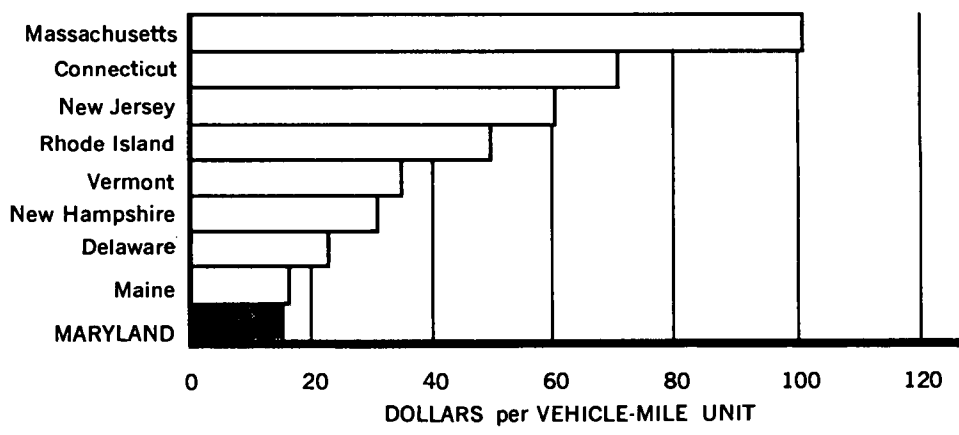
Figure 30
**UTILIZATION OF
 TRAFFIC
 ENGINEERING
 PERSONNEL**
 COMPARISON FOR
 SELECTED STATES
 1963



1/ Maryland figure revised upward to account for omission on inventory submission.
 Data: Annual Traffic Inventory Analysis for 1964, National Safety Council.

Figure 31 indicates that Maryland's expenditures on signs, signals and markings programs — considering vehicles-miles of travel — were the lowest of all nine states. Total expenditures for this purpose were considerably less than those of Massachusetts, Connecticut and New Jersey — even though Maryland's 1963 expenditures were almost eight times greater than those in 1962.

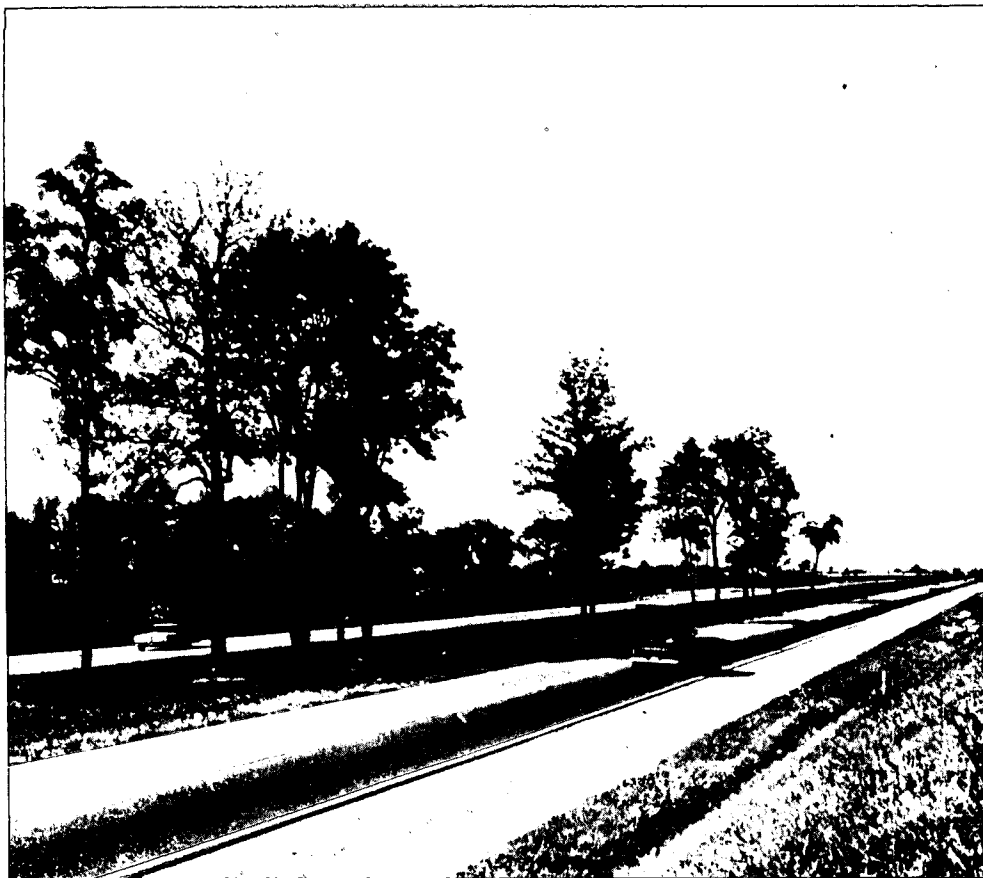
Figure 31
**TRAFFIC SIGNS,
 SIGNALS
 AND MARKINGS
 PROGRAMS**
 EXPENDITURE
 COMPARISON FOR
 SELECTED STATES
 1963



Data: Annual Traffic Inventory Analysis for 1964, National Safety Council.

The major implication of the foregoing is that there is a need to expend the scope of the Bureau of Traffic's activities to permit detection of specific problems and development of remedial measures on a continuing basis — before formal complaints arise. This should be accomplished by periodic surveys of regulatory measures and traffic appurtenances, studies of accident data and investigation of accident-prone locations. Problem areas should be studied and evaluated. Wherever possible, remedial measures should be effected as soon as practicable; however, more extensive improvement measures should be incorporated in an annual traffic engineering improvement program.

Recommendation. Expand the activities in the traffic engineering function to include periodic surveillance of the State Highway System, continuing determination of traffic needs, analysis of accident data and development of an annual program for traffic engineering improvements.



Finance

Financial management in highway operations involves planning, organizing and controlling the organization's financial resources. During this study, attention was directed to several aspects of financial management in the State Roads Commission as discussed below.

FINANCIAL PLANNING

In a broad sense, financial planning involves every action that the Commission needs to take to ensure (1) that there are reliable monetary estimates of the funds required for highway development programs, (2) that there are projections of funds available from current provisions to meet program requirements, (3) that the relationship between requirements and available funds is clearly reported to the General Assembly, (4) that the funds provided are utilized most effectively, (5) that the receipts and expenditures of funds are accounted for properly, and (6) that there are good fiscal bases for measuring performance, revising and improving estimates, and reporting progress.

Forecasting available funds and program requirements usually has been performed by the Commission on a crash basis in connection with needs evaluations and proposed programs. These evaluations should be made part of the continuous planning process. They are constantly needed as a basis for any indicated revisions in the current program and schedule and to assess overall progress in the light of changing conditions.

Since there is not a current long-range projection of the finances that will be available for highway development in Maryland as a result of actions taken by the 1964 General Assembly, the Consultant made an independent projection shown in Table 6 (based on the historical data in Table 5). This projection was made by the following method:

1. A U. S. Bureau of the Census projected population estimate was used as a basis. Maryland population is expected to reach 5,000,000 by 1985.
2. Driver age population was projected on the basis of the historical trend. There are expected to be 3,549,000 potential drivers by 1985 and 2,839,000 are expected to be licensed.
3. Historical trends of vehicle ownership — persons per vehicle and drivers per vehicle — were established on the basis of historical registrations.

Fiscal Year	Gasoline Tax Fund <u>1/</u>	Motor Vehicle Revenue Fund <u>2/</u>	Motor Vehicle Titling Tax	Federal-aid Apportionments <u>3/</u>	Total
1957	\$47,063,000	\$12,382,000	\$10,302,000	\$22,852,000	\$ 92,599,000
1958	47,357,000	11,244,000	9,434,000	29,648,000	97,683,000
1959	50,750,000	11,484,000	9,911,000	41,722,000 <u>4/</u>	113,867,000
1960	52,831,000	11,531,000	11,243,000	65,890,000	141,495,000
1961	54,598,000	11,334,000	10,956,000	49,350,000 <u>5/</u>	126,238,000
1962	57,878,000	11,292,000	12,245,000	58,652,000 <u>5/</u>	140,067,000
1963	61,412,000	11,995,000	13,949,000	54,625,000	141,981,000
1964	65,365,000	12,036,000	16,891,000	58,729,000	153,021,000

1/ Less provision for refunds and Gasoline Tax Division administration.

2/ Less deductions, including departments of motor vehicles and state police administration.

3/ Regular apportionments — Interstate, primary, secondary and urban.

4/ Includes "D" and "L" funds provided by 1958 Federal-aid Highway Act.

5/ "L" fund repayments have been deducted.

Data: Financial reports, State Roads Commission.

Table 5

NET REVENUES FOR HIGHWAYS FROM STATE TAX SOURCES AND TOTAL FEDERAL-AID APPORTIONMENTS

1957-1964

Table 6

ESTIMATED STATE AND FEDERAL FUNDS AVAILABLE FOR HIGHWAY PURPOSES

DURING THE 20-YEAR PERIOD 1965-1984 ^{1/}

Fiscal Year	Gasoline Tax Fund	Motor Vehicle Revenue Fund	Motor Vehicle Titling Tax	State Highway Construction Bonds	County Highway Construction Bonds	Federal-aid
1965	\$ 81,095,000	\$ 12,759,000	\$ 22,317,000	\$27,560,000 ^{2/}	\$3,990,000 ^{2/}	\$ 60,512,000
1966	86,316,000	14,290,000	20,865,000	32,500,000		63,455,000
1967	90,786,000	15,575,000	19,621,000			50,188,000
1968	96,230,000	17,151,000	19,859,000	not estimated — issues limited to \$25,000,000 annually	not estimated	51,517,000
1969	101,337,000	18,605,000	21,064,000			51,517,000
1970	106,000,000	19,911,000	19,076,000			51,517,000
1971	112,000,000	22,000,000	20,000,000			50,000,000
1972	117,000,000	23,000,000	22,000,000			55,000,000
1973	122,000,000	24,000,000	20,000,000			57,000,000
1974	127,000,000	26,000,000	20,000,000			59,000,000
1975	131,000,000	27,000,000	20,000,000			62,000,000
1976	135,000,000	28,000,000	20,000,000			64,000,000
1977	138,000,000	29,000,000	20,000,000			67,000,000
1978	143,000,000	30,000,000	20,000,000			70,000,000
1979	146,000,000	31,000,000	20,000,000			72,000,000
1980	150,000,000	32,000,000	20,000,000			75,000,000
1981	153,000,000	32,000,000	20,000,000			78,000,000
1982	156,000,000	33,000,000	20,000,000			81,000,000
1983	159,000,000	33,000,000	20,000,000			85,000,000
1984	162,000,000	34,000,000	20,000,000			88,000,000
Total	\$2,513,000,000 ^{3/}	\$502,000,000 ^{3/}	\$405,000,000 ^{3/}	No New Revenues	---	\$1,292,000,000

^{1/} State funds based on current provisions. Federal-aid through 1971 based on current projections by State Roads Commission. Federal-aid after 1971 based on Federal-aid Primary System needs in Maryland from Section 210 study (1956 Federal-aid Highway Act) as compared with national total from the same study.

^{2/} Figures from 1965 fiscal budget.

^{3/} Less 13 to 14-million-dollar annual average from current revenue sources for debt service and bond retirements, based on reducing bonded debt in half by 1980.

Data: Estimates based on projections made by the Consultant.

4. These trends were projected and leveled off at 1.2 drivers per passenger car and 2.1 persons per passenger car, to be attained in 1974. There now are 1.3 drivers and 2.7 persons per car.
5. On the above basis, there will be 2,366,000 passenger cars and 331,240 pickup trucks and heavier vehicles registered in 1985.
6. Trends in miles traveled and fuel consumption characteristics per vehicle then were applied to give projections of 25,908,000,000 annual vehicle-miles of travel and 2,499,730,000 gallons of highway fuel consumption by 1985.
7. Tax rates and other provisions enacted by the 1964 General Assembly were applied to these projections.
8. Federal-aid was projected on the basis of relative needs on the Federal-aid Primary System in Maryland compared with national needs on the same system as developed in the most recent national needs survey. The FAP system basically represents seven per cent of the rural road mileage in each state.

The estimate of federal-aid is presented only as an indication of a reasonable possibility. Decisions on the future of federal-aid probably will not be reached in the national Congress before 1967.

No attempt was made in this analysis to break down the distribution of revenues shown in Table 6 between the State and other jurisdictions because of the problems of predicting federal-aid distributions and bond sales. However, data in Table 6 lead to some significant conclusions:

1. The revenues provided through present legislation and possible future federal-aid appear to provide the funds reported as needed in the recent 20-year needs study, although there are indications — as shown in other sections of this report — that the 20-year needs estimates may be low.
2. No significant amounts of new revenues can be derived from bond sales for state highway development under current debt limitations.

The budgeting process of financial management affects, and is closely related to, the basic management functions of planning and controlling. The budget should reflect the commitments of the organization to engineering, construction, salaries and wages, maintenance and other activities, and in that sense should express goals to be accomplished.

BUDGETING

From the standpoint of control, a well-conceived budgetary process can make an effective contribution in that it provides a basis for comparing actual performance with planned performance over short periods of time.

In the Commission, the preparation of the annual budget is centered in the Comptroller. The basic elements of the process are as follows:

1. The Comptroller, with the cooperation of the state agencies responsible for tax collection and through analyses made by consultants, establishes a projection of highway revenues to be available during the ensuing fiscal year.
2. Since the Commission receives and distributes to the counties 20 per cent of revenues from the Motor Vehicle Revenue Fund and the Gasoline Tax Fund, these are set aside to be distributed by formula.
3. Debt service requirements, to be paid into the sinking funds as specified by law, then are set aside.
4. The expenditures for personnel payments then are set aside, or earmarked.^{42/}
5. The balance of projected revenues then are available for equipment, supplies, materials, fixed assets and contracts.
6. Maintenance funds are supposed to be derived from the Motor Vehicle Revenue Fund. This source has not provided adequate funds during recent years and the General Assembly has specified the transfer of funds from other sources. This has been considered a transfer of construction monies.
7. The budget then is prepared through judgment as to the requirements for engineering, right-of-way acquisition, construction and other expenditures as indicated by the currently approved program.

From a review of the existing budgetary processes, and relating them to generally accepted concepts of budgeting, several conclusions can be drawn.

^{42/} In the past, expenditures for personnel were based on positions established as of September 1 of the preceding fiscal year. In preparing the budget for fiscal 1966, the Commission is required to specify the number and classification of the positions it expects to be filled during the fiscal year. This procedure requires organizational unit heads to become involved in making estimates of personnel needs.

- There is need for the development of budgeting processes more closely related to performance.

Essentially, the existing budgeting process presents expenditure estimates in the form of objects of expenditure — rather than expenditures for specific work to be accomplished. The budget does not show what work is intended to be accomplished. It shows only what money is to be spent for supplies, equipment, maintenance, construction and other activities.^{43/}

It should be emphasized that the bases for the kind of performance-related budgeting described above do not presently exist, since accurate time and cost requirements for doing work have not been established. This lack again emphasizes the need for improved programming and scheduling procedures and for research to establish performance standards in maintenance activities.^{44/}

- There is need for a greater degree of participation by unit managers in the budgeting process.

Under the existing system of budgeting, the managers in charge of organizational units — who should be responsible for actual work accomplishment — are not involved in the budgetary process to any significant extent. As a result, they do not view the budget as providing a means for measuring performance of work for which responsibility has been assigned.

- The existing budgetary process does serve effectively to control total expenditures.

Since the existing budgetary process is not related directly to the various work programs, it follows that approved budgets do not provide an effective basis for measuring and controlling work performance — and they are not used for these purposes. However, the approved budgets are utilized for overall expenditure control in what appears to be an effective manner.

^{43/} Because of legislative provisions, the funds for salaries and debt service are related, in a broad way, to performance.

^{44/} As recommended in the highway planning and operations sections of this report.

FINANCIAL REPORTS

Financial reports provide the basic information for any financial planning and control system.

At the present time, the Commission develops and publishes a number of financial reports. Among these are:

1. Annual Financial Report, which provides fund reconciliation.
2. Summary of Fiscal Year Expenditure Budget, which provides budget reconciliation.
3. Semi-Annual Cash Forecasts, which provides expenditure control and information.

In addition to these kinds of reports, statements are provided after the budget is formulated and at intervals to acquaint management with the general status of funds.

Review and analysis of the financial reports developed in the Commission reveals that they are comprehensive and complete, and serve to exercise adequate control over expenditures of monies entrusted to the Commission. However, they do not provide information relating performance of the organization as a whole, and individual units within it, against a plan for specific work accomplishment — nor are they intended to since the budgetary process is not directly related to work programs.

Recommendation. Modify budget formulation procedures to require more participation by unit managers and utilization of the budget to measure performance and as a basis for remedial action when appropriate.

This recommendation envisages a budgeting process wherein:

1. Organizational unit managers are responsible for establishing and accomplishing objectives, and participate in the formulation of the budget.
2. Monetary values are assigned to the factors required to accomplish objectives — personnel payments, equipment and materials. Thus, the completed budget reflects the objectives, and plans for accomplishing them, of each major organizational unit.
3. A reporting system exists to report actual performance against planned performance and thus provide a basis for remedial action where needed.

It is recognized that the present budgetary processes are satisfactory for controlling overall expenditures. What is recommended is that addi-

tional refinements be made to allow utilization of the budget as a tool for improving performance.

It also is recognized that implementation of this recommendation is contingent on the development of performance standards, reliable time and cost data for doing work, and improved planning and scheduling — much of which will result from implementation of recommendations related to programming, scheduling and maintenance. Implementation also is contingent on more flexibility in existing legislation.

One of the problems concerning present financial reports is their number and complexity. This is dictated to a large extent by present legislative requirements which earmark specific funds for specific purposes. Reports need to be formulated to satisfy the accounting requirements of the various funds. For example, funds for the Twelve-Year and Federal Interstate Programs have been distinguished by legislation from funds for other state programs; the Gasoline Tax Fund, after county distributions and debt service, is earmarked for construction; and the Motor Vehicle Revenue Fund is earmarked for maintenance.

Recommendation. Establish a State General Highway Fund to receive all revenues allotted to the Commission without stipulation as to the specific uses of the fund for programs or types of work accomplishment — except for debt service requirements.

In addition to removing some of the complexities of financial management, adoption of this recommendation is needed to permit the necessary degree of flexibility to the Commission — treated elsewhere in this report — to plan its maintenance operations in accordance with needs and to plan, develop and construct improvements without undue financial restraints.



Organization

The organizational structure of the State Roads Commission should serve to establish relationships between functions, physical factors and personnel in such a manner as most effectively to accomplish the Commission's objectives. It should be so arranged that it facilitates coordination and control of activities and the exercise of effective leadership by managerial and supervisory personnel.

The evaluation of the organization was directed to (1) the definitions of responsibilities and authority, (2) the existing relationships and administrative practices, and (3) the operating procedures. The results of these analyses are reported in the following sections.

TOP MANAGEMENT

Top management in a Commission-Director form of organization — such as that of the State Roads Commission — consists of the Commission, the Chairman-Director and the heads of the major functional divisions. The responsibilities of top management are to provide:

1. Far-sighted planning and clarification of objectives — determining the needs of the road system and the most advantageous future course to satisfy these needs.
2. A sound plan of organization — an organization which functions effectively to achieve established objectives.
3. Highly-qualified persons in all key positions — to assure that each individual and unit contributes to the accomplishment of objectives.
4. Effective means of control — to permit top-level managers to delegate wide responsibility and authority, thus freeing themselves of administrative details in order to concentrate on broad planning, direction and control.

Effective operation of top management requires that there be a clear definition of responsibility, authority and principal relationships of each of the levels — based on a clear concept of the division of work between policy-making and administration. For this reason, attention was directed to analysis of the responsibilities, authority and relationships of top management and the functions performed by it.

Statutory provisions spell out the functions of the Commission as follows:

RESPONSIBILITY AND AUTHORITY

"[it] shall have full powers and be charged with the full duties to select, construct, improve, and maintain such a general system of improved State roads and highways, as can reasonably be expected to be completed with the funds herein provided, in and through all the counties of this State. Provided the State Roads Commission shall not make policy determinations related to highway locations, schedulings, substitutions and priorities without first consulting and conferring with local area and municipal government officials." ^{45/}

These provisions indicate an apparently clear intent on the part of the General Assembly that full responsibility and authority for planning, developing and operating the State Highway System be vested in the Commission organization provided that, in the fulfillment of its responsibilities, the needs of counties and other local units be considered.

A more specific definition of the responsibilities and authority of the seven-member Commission and the Director of Highways (prior to the 1964 enactments) is contained in the following statutory provision:

"The Director of Highways shall have exclusive jurisdiction and control over the location, construction, geometrics, design and maintenance of the highways that embrace the interstate system of highways and the highways that embrace the primary system of highways, as the primary system is hereinafter defined The Director shall also have complete jurisdiction and authority over the engineering and right-of-way departments of the Commission and the entire organization of the Commission itself. It shall be his duty to carry out and cause to be performed the construction and maintenance of highways on the secondary system after the policy relating to construction and maintenance has been formulated by the Commission." ^{46/}

The statutes further provide:

"The Commission meeting jointly shall formulate matters of policy relating to location, type, design, construction and maintenance of the secondary system of highways. It shall be the duty of the member of the Commission from the

^{45/} Laws Governing State Roads of Maryland, Article 89B, Section 7, State Roads Commission of Maryland, 1960. The last provision was enacted in 1958.

^{46/} Ibid.

area where the secondary road under consideration is located to inform the other members of the Commission of local conditions which would affect the location, design, construction and maintenance of such secondary highways." ^{47/}

In addition to the above, the Commission is empowered to recommend an overall highway improvement program to the executive and legislative branches of the government, and to make recommendations to the Governor and the General Assembly relating to highway financing. ^{48/} The Commission also is required to determine the extent to which consulting engineers will be employed on the entire State Highway System and the general working conditions and salary recommendations relating to the Commission's employees. ^{49/} The Director has final authority to determine which highways will be considered primary and which secondary — and to change these — after advising with the Commission. ^{50/}

Legislative enactments in 1964 require the seven-member Commission to approve improvement programs for the primary as well as the secondary systems, ^{51/} and this body also has been directed to review, modify or terminate all existing consulting engineering agreements as will be in the best interests of the Commission. ^{52/} Although these provisions appear to change the responsibilities and authority assigned to the Commission and the Director, those with regard to program approval appear to be intended to apply only to the three two-year programs (1965-1970) — no provisions being made for ensuing years. It is significant that the 1964 legislation did not indicate that the existing provisions in Article 89B, Section 7 — relative to powers and duties — be amended.

Relating the above provisions to generally accepted concepts of top management organization and operation leads to several conclusions.

- There is need clearly to define the responsibilities and authority of the Commission.

It is apparent that the concept of the General Assembly as to the function of the Commission organization before 1964 was that it should

^{47/} Ibid.

^{48/} Ibid.

^{49/} Ibid.

^{50/} Ibid., Section 7B.

^{51/} Senate Bill 2, Section 211J (1964).

^{52/} Ibid.

be fully responsible for — and have commensurate authority for — planning, developing and operating the State Highway System — with provision for consulting and advising with local governments. The 1964 enactments gave power to the counties to substitute within certain limitations, the order of construction of projects. This represents an apparent departure from the hitherto prevailing concept and, in effect, divides responsibility and authority between the Commission and the counties. The effect is that the Commission is responsible for developing programs, but its authority is not commensurate because counties have authority to substitute projects in the program. The possible adverse effects of such substitutions were described previously. ^{53/}

Consideration of the 1964 legislation, in relation to the past history of non-accomplishment of programs within original time and cost estimates, indicates that the General Assembly expressed its feeling that counties — and the seven-member Commission — should have greater authority in determining what projects will be undertaken, and when. The fact that such an expression was believed necessary emphasizes the need for improved highway planning processes in the Commission.

While there is no doubt that the highway needs of counties and other local units must be given full consideration as the Commission goes about its business of planning, developing and operating the State Highway System, these needs should be determined in the long-range planning process. Projects then should be selected from the long-range plan to give proper recognition to priorities and to a logical phasing of construction work — all related to forecasts of funds available. The Commission should have final responsibility and authority for developing the program — and be held accountable for adequate performance in the fulfillment of its responsibilities.

- There is need clearly to define the responsibilities, authority and principal relationships of the Commission body and the Director of Highways.

The statutory provisions relative to responsibilities, authority and relationships of the seven-member Commission and the Director reflect a philosophy that policy formulation and determination of needs on the secondary system can most effectively be done by the Commissioners, while those relative to the Interstate and primary systems can most effectively be done by the Director. In actual fact, essentially the same processes must be performed in planning (including policy formulation and determination of needs), developing and operating each of these systems.

^{53/} In the sections dealing with programming and scheduling.

Moreover, if it is accepted that the basic function of the Commission is to plan, develop and operate the State Highway System as a total, integrated system to provide highway transportation facilities for the whole State, it is inconsistent to have responsibility for policy formulation and needs determination assigned to two different units of the organization. The basic management principle that there be unity of command toward objectives would dictate that policy formulation and needs determination functions for all systems be placed in one unit or level of the organization — to achieve most effective coordination and unified direction toward accomplishment of objectives.

One other factor is pertinent to the above. Analysis of the origin of the classification system for state roads reveals that it arose primarily as the result of federal-aid provisions and requirements — rather than in response to needs related to policy formulation and needs determination for different systems.

A part-time Commission/full-time Director form of organization requires a clear concept of division of work between the two — the basic division based on the differences between policy formulation and administration. The part-time Commission should confine its activities to policy formulation — the determination of what is to be done and when — and review, appraisal and evaluation of overall programs and progress toward objectives. The Director should be the chief executive with responsibility, authority and accountability for general administration of the organization — within the basic policies established by the Commission.

- There is need for delegation of decision-making relative to administrative and operating matters, and need for more effective means of control — to permit the Commission, the Chairman-Director and the heads of major units to concentrate attention on broad planning, direction and control.

Analysis of the activities of the Commission — based on review of minutes of Commission meetings for a period of one year, review of several randomly selected sets of minutes of meetings covering a period of some three years, and attendance at Commission meetings — reveals that this body devotes a considerable amount of time to matters that are primarily administrative in nature and apparently wholly amenable to coverage by policy. The frequency of Commission and Director action on such matters for calendar year 1963 is shown in Table 7. Such items as the following appear frequently:

1. Approval of traffic regulating measures.
2. Resolutions re condemnation proceedings.
3. Authorization of expenditures for right-of-way.

Table 7

NATURE OF ACTIONS TAKEN AT COMMISSION MEETINGS

1963

Subject	Action Taken	Item	By Commission	By Prior Approval of Chairman
Right-of-Way	Approved	Right-of-way appraisal	1	-
	Authorized	Right-of-way purchase	13	11
	Accepted	Bids for excess land	-	15
	Accepted	Bids for purchase and removal of improvements	-	57
	Authorized	Sale of excess land	2	3
	Accepted	Awards by Board of Property Review	3	208
	Directed	Appeal Award by Board of Property Review	-	95
	Resolution	Condemnation proceedings	330	-
	Executed	Conveyance of deeds	11	69
	Executed	Right-of-way agreements	-	11
	Executed	Lease agreement — property rental	-	100
	Resolution	Miscellaneous — special concessions, settlements, etc.	14	3
Finance	Authorized	Expenditures — right-of-way	108	833
	Authorized	Expenditures — construction and maintenance	31	723
	Approved	Invoices	4	16
	Authorized	Final payments	-	85
	Authorized	Pasting right-of-way payments — Circuit Court	60	-
	Adopted	Tunnel and bridge budget	1	-
	Approved	Banding, etc.	2	-
Contracts	Executed	Consultant agreements	-	87
	Executed	Federal-aid agreements	-	115
	Executed	Contract employee agreement	3	22
	Approved	Bid	1	88
	Awarded	Contract	6	102
	Authorized	Sub-letting	-	152
	Authorized	Extra work agreement	1	31
	Approved	Contract change order	-	10
	Executed	Utility, service, maintenance, miscellaneous	-	9
	Executed	Project agreement	-	1
Traffic	Approved	Property condemnation reports	-	258
	Authorized	Bridge weight and size postings	-	2
	Approved	Traffic regulating measures	194	-
	Authorized	Overhead sign	1	-
	Approved	Tall road rules and regulations	2	-
Systems	Executed	Signs and markings agreement	-	1
	Accepted	County road into county system	1	33
	Accepted	County road into state system	6	4
	Referral	Miscellaneous referrals for study, new locations, etc.	2	1
Planning Programs, Schedules	Presentation	Needs studies, programs	6	-
	Approved	Program	1	-
	Approved	Program changes	9	-
	Approved	Advertising schedule change	1	-
	Authorized	To proceed on specific project using emergency funds, etc.	2	-
Policy and Procedure	Approved	Policy memorandums	6	-
	Referral	For study and report	3	-
Miscellaneous	Various	Revision in specifications, letters of understanding, county awards, use of emergency funds, notifications, district boundary changes, committee appointments, capital equipment approval, research agreements, extensions for local use of federal-aid funds, release of funds, bridge names, etc.	82	68

Data: Minutes of State Roads Commission meetings.

4. Authorization for posting right-of-way payments to Circuit Courts.
5. Miscellaneous — revisions in specifications, letters of understanding, use of emergency funds, notifications.

The use of the Commission's and the Director's time for such matters as these, many of which could, and should, be acted on at a lower level — within established policies and procedures — prevents the Commissioners and the Director from devoting attention to matters of greater importance.

Study of the daily activities of the Chairman-Director for a period of approximately 30 days, and examination of a log of his activities, revealed that he has an extremely busy schedule. In addition to meeting with the Commission on an average of twice a month, he is called on to maintain relationships with a large number of local, state and federal organizations and officials. He also is called on rather frequently to address various citizen groups, and attends a number of professional meetings. He reads and signs appraisals and other authorizations — quite frequently in evenings at his home. All these demands are in addition to the time he must spend with his staff in performing his function of general management.

It is not suggested that the Chairman-Director refrain from performing all the activities mentioned above. To the contrary, a great number of these are valid demands on his time. The plain fact is that the chief executive of an organization like the Commission must, of necessity, devote much of his time and attention to matters not directly concerned with the day-to-day direction and coordination of the activities of the major units of the organization. Consequently, his orientation must, perforce, be "upward" in relation to the operating organization. At the same time, there is need for an executive whose orientation can be "downward" in relation to the operating organization — to provide active direction, coordination and control of the activities of that organization.

THE OPERATING ORGANIZATION

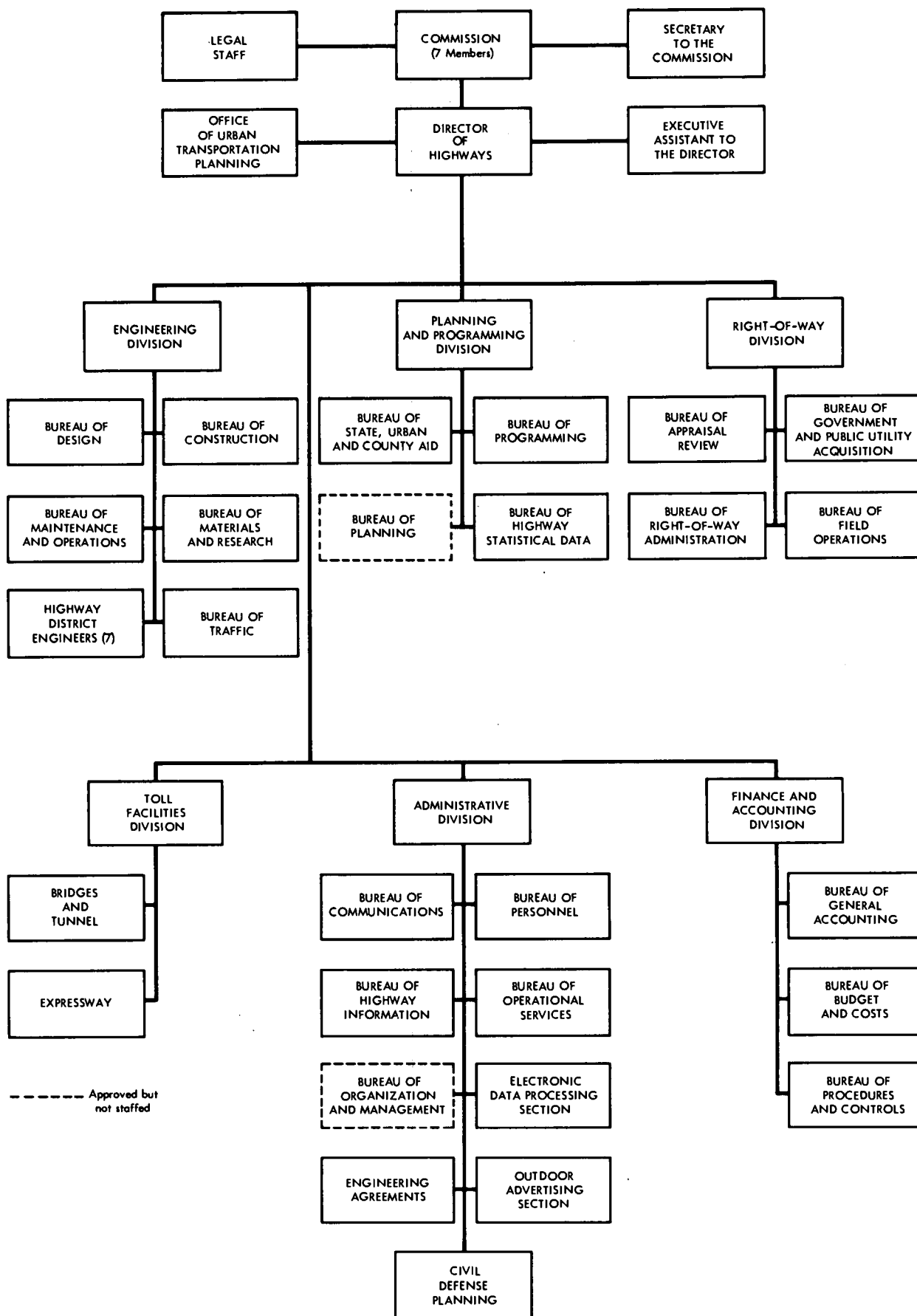
The operating organization of the State Roads Commission consists of two major components — the Central Office and the districts — with different functions and responsibilities. Various aspects of the operation of these two components are treated below.

THE CENTRAL OFFICE

The structural arrangement of the various organizational units in the Central Office is as depicted in Figure 32. The grouping of activities in the six major functional units of Administration, Engineering, Finance and Accounting, Planning and Programming, Right-of-Way and Toll Facilities follows a logical pattern based on a concept that the major units be defined according to their functional nature and the specialized skills required to perform them — and that specific units be grouped within the

Figure 32

EXISTING ORGANIZATIONAL STRUCTURE MARYLAND STATE ROADS COMMISSION



major units on the basis of functional similarity. The organizational pattern is similar to that of a number of state highway departments.

During the past several years increasing attention has been devoted to structural arrangement of highway departments, and some new concepts have emerged. A basic change in structural arrangement has resulted from recognition that the development of management systems — such as computerized multiple-project scheduling systems and management reporting systems — often requires that activities be regrouped according to the interdependencies and interrelationships (coordination) required in processing, even though the specific nature of the activities and the skills required to perform them may differ.

It is apparent that there is critical need for the development and operation of a multiple-project scheduling system in the Commission. Implementation of such a system will require an organizational arrangement somewhat different than the one which now exists — if greatest effectiveness is to be achieved. A recommended organizational structure is explained in a later section.

THE DISTRICTS

In highway department operations, the districts are primarily operating units — their major missions being to maintain the roads and supervise contract construction. To the people who live within a district's boundaries, the District Office represents the Commission and, by and large, the image of the Commission is created by the district.

In overall perspective, the function of the Central Office generally should be to develop and establish programs to be accomplished, establish policies and procedures to guide district personnel in actually doing the work, and to exercise overall control — including evaluation and guidance. This does not mean that districts are only "doers" and not "thinkers." To the contrary, district personnel should be involved in planning processes and should plan, schedule and control their operational activities.

In relating the above concepts to the existing operations of the Commission, several conclusions can be drawn.

- There is need for district personnel to be more involved in the process of program development — in both construction and maintenance — than they now are. Part of the difficulty stems from the fact that there is lacking a highly effective programming and scheduling process — which tends to cause centralized decision-making regarding construction and maintenance programs.

- There is need for responsible district personnel to have more information — farther in advance — regarding construction plans, programs and schedules in their districts. This need stems from the fact that (1) such information is needed in order for district personnel adequately to plan and schedule their work, and (2) there is a major public relations advantage to the Commission which can be realized if responsible district personnel are fully informed about future plans. Before this kind of information can be given to districts, however, it is necessary to have firm and realistic programs and schedules.
- There is need more clearly to define the role, responsibilities and authority of districts and district personnel — and to provide sound bases for decision-making by these officials. Because of the major responsibilities which districts have (whether defined or not), it is extremely important that these responsibilities and authority be clearly defined and that policies and procedures be formulated which provide guidelines to decision-making.

In this section, recommendations are presented for improving the organization and administration of the State Roads Commission.

RECOMMENDATIONS

Recommendation. Adopt the philosophy that the Commission organization has full responsibility, authority and accountability for planning, developing and operating the State Highway System.

ORGANIZATION

The intent of this recommendation is to establish a setting within which to view the role of the Commission organization. The substance of such a statement may be considered to be embodied in some sections of existing legislation and court decisions. Nonetheless, the 1964 enactments which place authority in counties to substitute, within certain limitations, projects in the program may well have the effect of making effective performance and attainment of established objectives more difficult, if not impossible.

It is recognized that the General Assembly has a major role to play, and great responsibility, regarding highway matters. The recommendation envisages that the General Assembly will declare, in general terms, the powers and duties of the Commission, the Director of Highways and the operating organization — and leave specific administrative details

and operating procedures to be developed within reasonable basic policies, procedures and rules established by the Commissioners.

It also envisages that the General Assembly will require such periodic reports as are necessary to assure that it knows the needs of the highway system, the programs proposed to satisfy the needs and the progress toward program objectives — all as a basis for making financial decisions with regard to highways.

Recommendation. Establish a three-member State Roads Commission to operate on a part-time basis with responsibility and authority for (1) establishing basic policies and procedures to guide the organization in achieving the aims of the General Assembly, (2) reviewing, appraising and finally approving major programs, and (3) reviewing and evaluating performance of the organization.

This recommendation anticipates that a three-member Commission will be established — the viewpoint of each member, and of the Commission as a whole, to be state-wide and not representative of any one particular geographical area of the State or any one particular classified highway system. This is in keeping with the basic concept that the Commission is responsible for planning, developing and operating a total, integrated State Highway System to fulfill the highway transportation needs of Maryland.

This three-member Commission should be delegated, by statute, the responsibility and authority to:

1. Formulate the basic policies and procedures of the organization.
2. Review, appraise and finally approve the major programs developed and proposed by the Director of Highways and his staff. This is in keeping with the concept that the Director of Highways be the chief executive of the organization and be responsible for assuring that there is a competent professional organization to determine highway needs, to develop programs calculated to satisfy these needs and to operate in an efficient manner to accomplish approved programs — all within basic policies and procedures established by the Commissioners.
3. Review and evaluate operations of the organization, progress toward objectives and results of operations — and assure action to remedy deficiencies.

Adequate performance of these functions will require a high degree of cooperation among the Commissioners, the Director of Highways and the top management staff. In addition, there must be studied effort to assure that the Commissioners do not become involved in details of ad-

ministration and operation. There will need to be established a system of summary reports covering major phases of the organization's operations — to assure adequate communication to the Commissioners.

Commissioners should be appointed by the Governor, to terms of six years, with terms staggered to assure continuity, and should be removable only for cause. Qualifications of members should include proven administrative ability, interest in public affairs and the development of the State, and high standing in the community. Service by Commissioners must be viewed as high public service for which adequate compensation cannot be made in monetary terms. It is recommended that Commissioners be paid a nominal annual fee, plus actual expenses while performing their duties.

The Commissioners should meet regularly — at least once a month and at such other times as deemed necessary.

Recommendation. Center in the Director of Highways the responsibility, authority and accountability for administration and management of the Commission organization — within basic policies and procedures established by the Commissioners.

As indicated previously, the function of the Commissioners should be one of policy formulation, and review and appraisal of programs and operating results. The Director of Highways should be the individual in whom is placed responsibility, authority and accountability for the organization's operations — within the scope of basic policies established by the Commission. His should be the function of overall planning, direction, coordination and control of operations.

In fulfilling his responsibilities, the Director's orientation should be upward and outward — organizationally speaking. He must work closely and harmoniously with the Commissioners in developing objectives and policies. It is important that proposed programs be submitted to Commissioners for their review, appraisal and final approval and that they receive adequate reports — written and verbal — of progress. In addition, the Director — personally or through his staff — should represent the organization at various legislative, financial and budgetary meetings. He should formulate operating policies — within the scope of the basic policies established by the Commissioners — and assure that he receives information as to operations of the organization.

The Director of Highways should be appointed by the Commissioners with the concurrence of the Governor and serve indefinitely at their pleasure.

Recommendation. Establish the position of Deputy Director of Highways — the incumbent to provide active direction, coordination and control of the major functional activities of the organization.

As pointed out previously, a great number of valid demands are made on the Director's time and attention. Many of these are not directly associated with direction, coordination and control of the operating organization. Yet, they require his time and attention to the extent that there is need for a subordinate position to assume the burden of such active direction, coordination and control. It is recommended that the Deputy Director of Highways perform the latter functions.

The fundamental differentiation between the Director's position and that of the Deputy Director is that the former should be concerned with the maintenance of sound relationships with the Commission and with governmental and civic agencies and individuals, and the latter should be concerned primarily with active direction, coordination and control of the operating organization. The Director should, of course, be finally accountable to the Commission for results of operations.

The Deputy Director should be appointed by the Director with the concurrence of the Commissioners and serve at their pleasure.

Recommendation. Organize the Central Office into five major functional units — the Offices of Development, Operations, Administration, Finance and Toll Facilities — and appropriate staff advisory functions as shown in Figures 33 and 34.

Figure 33 depicts the recommended plan of organization for top management and includes responsibilities and titles of unit heads. Figure 34 depicts the total structure, including the divisions within major units. The functions of each of the major offices are as follows:

1. The Office of Development. This function should be headed by the Chief Engineer, Development. It should be responsible for planning, programming, scheduling, design and right-of-way acquisition. A major reason for grouping these activities in one unit is the high degree of interrelation and interdependence which exists among them. In any system of multiple-project scheduling which may be developed, there will be required considerable coordination of the activities performed by the divisions within this unit — which will be greatly facilitated by this grouping.
2. The Office of Operations. This function should be headed by the Chief Engineer, Operations. It should be responsible for all operational activities carried on by the Commission —

RECOMMENDED ORGANIZATIONAL STRUCTURE AND PLAN OF OPERATION FOR TOP MANAGEMENT

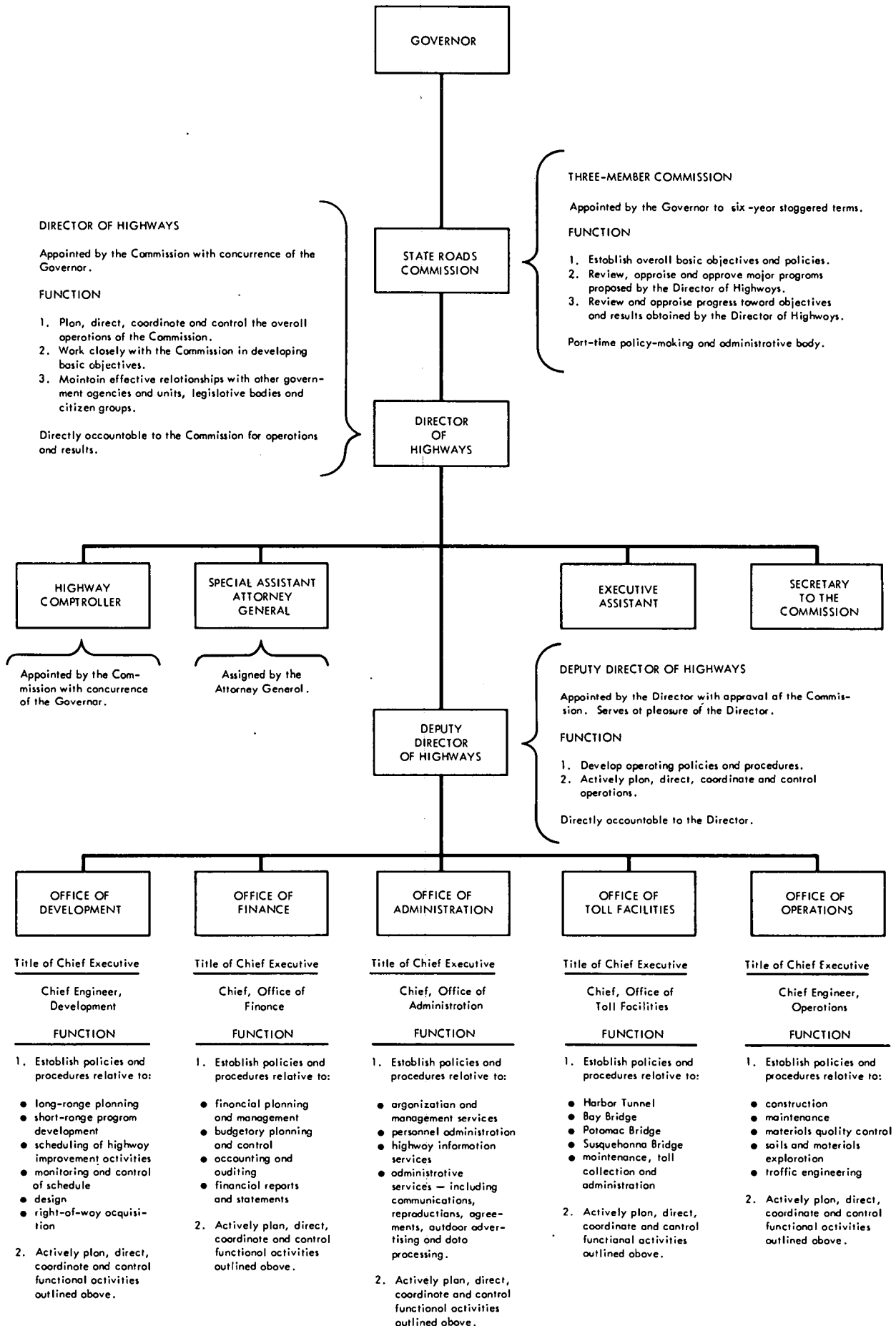
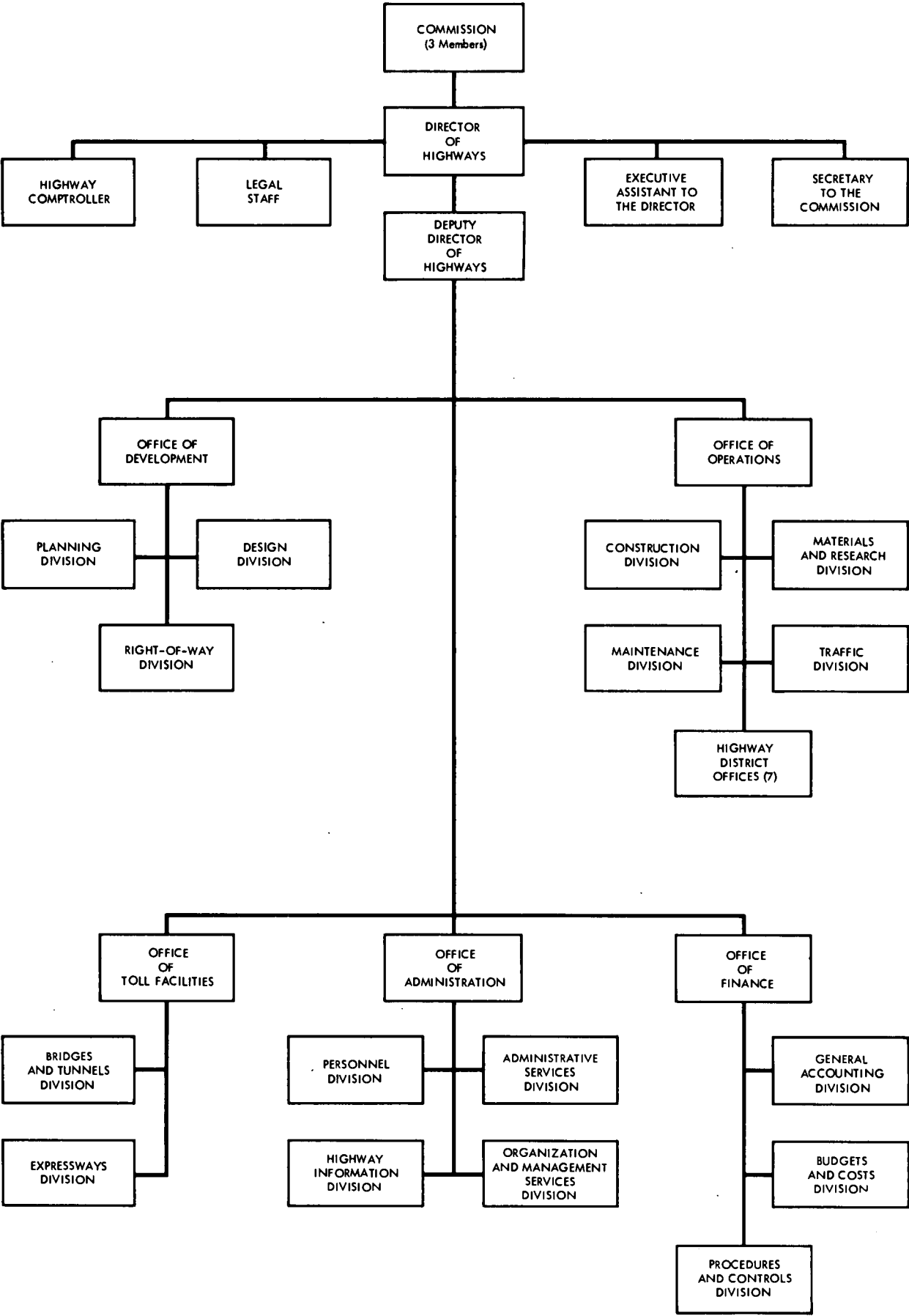


Figure 34
RECOMMENDED ORGANIZATIONAL PLAN
MARYLAND STATE ROADS COMMISSION



particularly construction contract administration and maintenance. The materials and research and traffic activities are grouped in this unit because of their close relationship and the services they provide the two basic operating activities. Such grouping will facilitate coordination among these activities.

3. The Office of Administration. This office should be headed by the Chief, Office of Administration. It should be responsible for performance of a number of service activities. It is recommended that this unit contain four divisions: (1) the Division of Personnel as now organized; (2) the Division of Organization and Management Services, to include the Bureau of Electronic Data Processing; (3) the Division of Administrative Services, including the Bureau of Operational Services, the Bureau of Communications, the Engineering Agreements Section, Outdoor Advertising and Civil Defense Planning; and (4) the Division of Highway Information.
4. The Office of Finance. This unit should be headed by the Chief, Office of Finance. It should be responsible for general accounting, budgets and costs, and financial procedures and controls.
5. The Office of Toll Facilities. This unit should be headed by the Chief, Office of Toll Facilities. It is recommended that the Executive Assistant to the Director continue to direct the activities of this office as he presently is doing — in addition to his duties as Executive Assistant.
6. Legal Staff and Executive Assistant to the Director. These units should continue to function as they presently do.
7. Highway Comptroller. The Commission relies heavily on bond financing for its total program. In addition, it is responsible for the administration of all toll facilities. The nature of the financial activities related to bond financing and toll facilities is such that there is required specialized knowledge and skills for effective operation. For these reasons, it is recommended that a position of Highway Comptroller be established — this individual to be appointed by the Commission with the concurrence of the Governor and to serve at their pleasure. He should act in an advisory capacity to the Director and the Commission on all matters related to highway financing, including toll facilities.

The preceding recommendations had to do with the establishment of a formal structure and logical relationships — a framework within which operations can be carried on and coordination achieved. Efficient performance, however, will depend as much on the administrative practices — those practices associated with direction, communications

ADMINISTRATIVE
PRACTICES

and control — as on the organizational structure. Recommendations concerning administrative practices are presented below.

Recommendation. Adopt the philosophy that responsibility and authority for making decisions should be delegated to as low a level in the organization as is practicable — and take aggressive action to implement this practice.

Decision-making in the Commission tends to be centralized at the top — manifested by the fact that the Commissioners, the Director and division managers are called on to devote considerable time and attention to matters which are amenable to coverage by policy and which could be acted on at lower levels in the organization. As a result, higher level managers are hard pressed to devote as much time as is desirable to overall planning, organizing and controlling.

A fundamental reason for centralization of decision-making has been the lack of a firm program and an effective scheduling system. Were such systems in effect, there would be a better basis for delegating decision-making because operations would be more stable.

Effective delegation is easier said than done. It requires, first, that there exist a philosophy that it be practiced (based on a firm policy statement to that effect). Secondly, it requires that certain prerequisites for effective delegation be instituted.

Recommendation. Develop, keep current and utilize a Commission-wide organization manual — in which are defined the functions and responsibilities of each organizational unit and the responsibilities, authority and relationships of each managerial and supervisory position.

The fundamental purpose of an organization manual is to define clearly the plan of organization as well as the responsibilities, authority and principal relationships of each managerial and supervisory position — in such form as to be easily communicated to all personnel and kept current. The benefits to be derived from such a manual are:

1. An increased understanding of the organization plan by all personnel, hence a minimization of misunderstandings relative to responsibility and authority.
2. A basis for decision-making, since each manager and supervisor will have clearly defined responsibilities and authority.
3. An effective tool for orienting newly promoted personnel and new employees.

Exhibit E is a sample illustration of a format for position guides which should be developed for each managerial and supervisory position.

Maryland State Roads Commission
POSITION GUIDE

Position Guide No. _____
Date: _____
Page ____ of ____

CHIEF ENGINEER, OPERATIONS

I. FUNCTION

Reports and is accountable to the Deputy Director of Highways.

Provides for the letting and award of improvement and maintenance contracts; directs and controls the construction, maintenance, traffic, and materials and tests functions; ensures compliance of field activities with established procedures and specifications; provides state-wide direction and coordination of district operating functions.

II. RESPONSIBILITIES AND AUTHORITY

A. Activities

1. Directs and supervises the following subordinate positions:

Director, Division of Construction
Director, Division of Materials and Research
Director, Division of Maintenance
Director, Division of Traffic
District Engineers

2. Participates in the development and review of policies and procedures governing overall Commission activities.
3. Reviews and recommends prequalification ratings for contractors interested in bidding on highway improvement projects.
4. Provides for the letting and award of highway improvement projects.
5. Directs the state-wide administration of highway improvement contracts.
6. Directs and controls the inspection of highway improvement projects.
7. Directs and controls the inspection and testing of materials for highway use.
8. Makes recommendations to the Standard Specifications Committee concerning construction, maintenance, traffic, and materials and tests specifications.
9. Directs and controls state-wide traffic engineering responsibilities.
10. Provides overall direction and control of district construction, maintenance, traffic, and materials and tests functions.
11. Serves as a member of the Executive Committee.
12. Serves as a member of the Research Committee.

B. Organization

1. Provides for an effective and economical plan of organization for those divisions and districts under the Office of Operations.

C. Personnel

1. Ensures that subordinate divisions and districts are adequately staffed, and that employees are trained and developed to the best advantage of the Commission.

Position Guide No. _____

Date: _____

Page _____ of _____

2. Approves personnel actions affecting subordinates.
3. Provides for performance review and appraisal of subordinates.

D. Finance

1. Reviews and recommends annual budgets for subordinate divisions and districts.
2. Ensures that subordinates properly administer and control their annual budgets.

III. RELATIONSHIPS

A. With the Deputy Director of Highways

1. Accounts to him for the state-wide direction, administration and control of the construction, maintenance, traffic, and materials and tests functions.
2. Keeps him informed of major plans and activities of the Office of Operations.

B. With the Chief Engineer for Development

1. Coordinates all highway operations responsibilities with the Chief, Engineer for Development.
2. Ensures that recommendations and plans submitted to the Deputy Director of Highways on highway operations matters are coordinated with and represent the composite views and requirements of the Chief Engineer for Development.

C. With the Chief, Office of Finance; the Chief, Office of Administration; the Chief, Office of Toll Facilities; the Legal Adviser and the Highway Comptroller

1. Coordinates with and utilizes the advice and services of these staff members in the execution of the highway operations function.

D. With the District Engineers

1. Provides state-wide coordination and control of district operations functions.
2. Directs District Engineers in the execution of district operations responsibilities.

E. With the U.S. Bureau of Public Roads

1. Maintains a cooperative relationship with the U.S. Bureau of Public Roads division office to ensure proper coordination of federal-aid projects.

F. With Federal, State and Local Agencies

1. Ensures that state-wide highway operations are properly coordinated with interested and affected government agencies.

There has been recognition of the need for such a manual — and the head of the Administrative Division has initiated action to develop one. However, such action should be accelerated and supported on a Commission-wide basis.

Recommendation. Develop a comprehensive policy manual — to contain general and operating policies related to all phases of the Commission's operations.

At the present time, Commission actions are communicated to division managers by the Commission Secretary — in the form of a Memorandum of Action, an Excerpt From the Minutes or a Policy Memorandum. There also exist formally stated policies in the manuals which have been prepared by some divisions — such as Construction, Right-of-Way and Maintenance.

The present policies, while useful, are something less than what is envisaged in the above recommendation. What is envisaged is a manual which results from a positive, deliberate effort to develop a set of policies to serve as guides to the Commission and all managers and supervisors in the organization. These policies should be comprehensive enough to cover all matters of an administrative nature — and should be codified and indexed in such a manner as to be readily utilized. The manual should be widely distributed to managerial and supervisory personnel, including field units.

Exhibit A in the highway planning section of this report illustrates a format considered useful for policy statements.

Recommendation. Develop statements of procedures — to augment the policy manual.

Policies are guides to decision-making and should indicate what is to be done. Procedures should indicate how things should be done. Normally, any subject covered by policy should be proceduralized. In other words, the policy statement usually requires development of a procedure to indicate when it is to be effected — and where responsibility and authority are placed for effecting the required action.

Exhibit D in the highway planning section illustrates a desirable format for stating procedures which grow out of policies.

Recommendation. Develop a comprehensive management control reporting system.

The Commission does not now have a well-developed management control reporting system — an essential element in effective managerial

control. Appropriate reports should be developed for various levels of management — and should show results attained in key performance areas of each organizational unit.

One of the basic responsibilities of top management is to establish effective means of control to permit top-level managers to delegate wide responsibility and authority, thus freeing themselves of administrative details so as to concentrate on broad planning and direction. Top management can delegate authority and responsibility for decision-making but it cannot relieve itself of final responsibility and accountability for performance — hence, there must be means of knowing what performance actually is and to provide a basis for corrective action. These are the purposes of management control reports.

Any system of management controls in a highway organization must be founded on (1) firmly established objectives, based on a reasonably firm program of construction projects and maintenance activities, (2) procedures which establish responsibility for accomplishing the objectives, (3) performance standards which provide criteria as to what constitutes satisfactory performance of the responsible unit, (4) appraisal of performance to determine how well objectives were accomplished, and (5) corrective action — what actions are needed to correct below-par performance.

It has been stated that there is need for a multiple-project scheduling system in the organization. This system, if developed, will furnish a basis for important management controls in that it will provide the following:

1. Firmly established objectives for each unit involved in processing projects — based on analysis of the sequence in which work must be performed and a knowledge of times required to perform tasks.
2. Timely reports of status and progress — to provide a basis for discerning necessary corrective action and keeping progress up to established target date objectives.

The need for research in maintenance — to define the maintenance workload in terms of measurable units and time and cost for performing such units — has been pointed out. The data in Figure 29 relative to maintenance expenditures reveal wide variations in districts for similar items. Undoubtedly, some variations will result from differences in terrain, traffic volume and other conditions — but the wide variations indicate opportunities for improvement. The objective of research in this area should be to define maintenance workloads in measurable units, the best methods, and time and cost estimates — all as a basis for planning and controlling maintenance work.

The need for developing budgeting processes more closely related to performance was discussed previously. The ability of the organization to engage in this kind of budgeting is dependent on the development of

reliable standards of performance in terms of time, costs, and personnel and equipment needed to perform budgeted activities.

The recommendations contained in this report will, if implemented, require that the Commission perform some activities which it is not now performing, and augment other activities. As a result, additional space will be required to accommodate more personnel associated with the planning, programming and scheduling activities. The Planning and Programming Division already is crowded and occupies space on two different floors in the headquarters building. Space also will be required for additional personnel in the Bureau of Maintenance and Operations. SPACE

There is approved a Bureau of Organization and Management in the Administrative Division, but it is not operational. A major reason for this is that there is no space available for the additional personnel required. In addition, there is need for space in which to conduct training activities of various kinds.

Recommendation. Conduct a thorough study of space requirements — giving effect to the recommendations in this report.

The Commission conducted a study of its space requirements in 1963. The report, submitted to the Director of the Maryland Planning Department, indicated that space requirements would, by 1965, exceed by 50 per cent the space available. The point was made that most of the additional space required was needed to relieve existing overcrowded conditions; the personnel complement was estimated to increase by less than 10 per cent over that for 1963.

Time limitations did not permit a detailed study of space requirements, but observations relative to facilities were made. These observations lead to the conclusion that there is need to study space and facilities requirements in the districts as well as the Central Office.

Personnel

Basic to the accomplishment of highway development objectives is the organization and management of manpower. Principal elements of personnel management are (1) determining and filling present needs, (2) utilizing manpower capacity, (3) identifying future needs, and (4) developing manpower to fill future needs. These aspects of State Roads Commission management performance were analyzed and evaluated during this study.

MANPOWER NEEDS

The State Roads Commission is required to develop manpower budgets to show the number of positions required in each personnel classification in each organizational unit. To develop these budgets, the Commission receives and reviews requests for manpower from the managers of each district, bureau and division.^{54/}

DETERMINING NEEDS

The methods used to arrive at manpower needs for the annual budget involve (1) judgments as to current and future workloads, (2) estimates of manpower required to accomplish workloads, and (3) judgments as to probability of approval. Requests to fill needs are subject to review, modification and approval by each successive level of authority in the Commission and by the Department of Budget and Procurement, the Governor and the General Assembly.

Table 8 shows excerpts from a typical manpower budget. The budget includes a comparison of the number of positions authorized in each personnel classification for the two previous budget periods and the number of positions requested in the current budget. It also includes a summary of the manpower requests and prior-year comparisons by work programs. This is the basis provided to the Governor and the General Assembly to analyze budget requests.

FILLING NEEDS

The State Commissioner of Personnel is responsible for general recruiting,^{55/} for examining the candidates and for furnishing the Commission with the names of the five persons who achieved the highest

^{54/}This procedure was initiated with the preparation of the 1965-66 fiscal year budget. Formerly, manpower budgets were based on existing complements as augmented during the working year.

^{55/}The Commission performs the work involved in recruiting for specialized highway positions — such as civil engineers and urban planners.

Table 8

TYPICAL MANPOWER BUDGET ITEMS FOR THE COMMISSION

FISCAL YEAR ENDING JUNE 30, 1965 ^{1/}

Persannel Classification	Number of Pasitians			Salary Allowance 1965
	1963	1964	1965	
Engineering Associate VI	80	98	110	\$ 1,025,733
Engineering Associate V	173	166	187	1,470,725
Engineering Associate IV	162	162	192	1,276,624
Engineering Associate III	247	248	257	1,452,478
Engineering Associate II	157	157	174	785,016
Engineering Associate I	184	180	220	820,715
Highway Engineer VII	3	4	4	62,604
Highway Engineer VI	21	18	17	231,225
Highway Engineer V	34	34	35	396,492
Highway Engineer IV	39	30	30	302,935
Highway Engineer III	-	-	2	15,600
Highway Engineer II	10	10	12	88,005
Highway Engineer I	20	20	24	159,638
Total ^{2/}	3,823	3,823	4,060	\$21,997,741
Summary of Personnel by Program ^{3/}				
State System Construction	1,285	1,257	1,392	7,249,000
State System Maintenance	1,318	1,318	1,383	4,898,663
Mator Vehicle Weight and Size Enforcement	71	74	74	386,059
Total ^{2/}	3,823	3,823	4,060	\$21,997,741

^{1/}This is nat a complete transcript of the manpower budget. Typical sections have been selected as examples.

^{2/}The tatals are the actual tatals from the manpower budget, nat the tatals far the line items shown.

^{3/}The full summary far all programs is nat shown. Typical sections have been selected as examples.

Data: Persannel Detail of the Maryland State Budget, J. Millard Towes, Gavernar, February 1964.

scores.^{56/} The Commission is responsible for selecting and appointing one of the five persons certified for consideration.

All appointees serve a probationary period of one to 12 months. The usual period is six months — but action can be initiated to reduce the period to one month or extend it to 12 months. The Commission is authorized to reject, during the probationary period, one person in each personnel classification every three months.

Positions to be filled by promotion from within the Commission essentially require the same procedures as used in recruiting.

The major reason for the rather detailed treatment of the above is to indicate the extent to which the Commission's personnel management activities are prescribed by policies and procedures established and administered by other agencies. The net effect of the above provisions is to create a situation in which the Commission has a relatively small degree of latitude in these areas.

MANPOWER UTILIZATION

The State Roads Commission is responsible for ensuring that the persons appointed to the various positions effectively perform the work for which they were employed. The fundamental tools of supervision and control include (1) performance evaluations, (2) salary management, (3) disciplinary action, and (4) incentive awards.

PERFORMANCE EVALUATIONS

The Commission is authorized to reject one probationary employee in each personnel classification within each three-month period. The number of persons granted probationary appointments approximated 600 or more during the fiscal year ended June 30, 1963.^{57/} Of these, 13 — or about two per cent — were rejected during the probationary period.

The Commission further is authorized to extend the probationary period of any person to obtain more opportunity to evaluate performance before granting permanent status — subject to approval by the State Commissioner of Personnel. The probationary periods of 50 persons were extended during the year ended June 30, 1963 — which indicates management concern with regard to performance capacity.

^{56/} Veterans of the armed forces receive absolute preference.

^{57/} Most of the manpower statistics contained herein relate to the fiscal year ended June 30, 1963 — the last year for which complete statistics were available.

As required by law and by merit system rules, the Commission evaluated the efficiency of approximately 2,700 permanent employees during 1963. All employees were rated satisfactory or better.

The laws and rules provide for automatic salary increases at the rate of one step per year. The Commission is authorized — subject to final approval by the State Commissioner of Personnel — to deny an employee a regular increase under the following conditions: (1) if the probationary period is extended, (2) if the employee is suspended for disciplinary reasons, (3) if the employee is inefficient in the performance of work, and (4) if the employee is absent too frequently.

SALARY MANAGEMENT

A review of personnel records during the year ended June 30, 1963, indicated that all employees received the annual salary increase.

The Commission is authorized to suspend an employee for up to 15 days annually for disciplinary reasons, and to recommend extended suspensions, demotions and dismissals for more severe cases of unsatisfactory performance or behavior. Commission actions during the year ended June 30, 1963, were as follows:

DISCIPLINARY ACTIONS

Suspensions	3
Demotions	5
Dismissals	2
<hr/> Total	<hr/> 10

Inasmuch as the same persons may have been involved in two or more disciplinary actions, the total number of persons against whom actions were taken may have been as low as five or as high as 10 — 0.2 to 0.3 per cent of the employee force.

An employee suggestion system permits employees to receive awards ranging from written commendations to \$5,000 in cash for money-saving suggestions. Commission employees submitted 10 suggestions during fiscal year 1963 — one of which was worthy of a written commendation, one was still pending at the end of the year and eight were rejected.

INCENTIVE AWARDS

It is significant that nearly 3,600 employees — engaged in an activity as diverse as highway construction and maintenance — developed only one worthy suggestion during a full year of work.

The Consultant was interested in projecting manpower needs of the State Roads Commission. To develop such projections, it is necessary to identify and analyze (1) the turnover that will result from retire-

FUTURE MANPOWER NEEDS

ments and attrition, (2) the workloads that will be performed in the future, and (3) the number of persons that will be required for the performance of future workloads.

TURNOVER

The Commission experienced a 7.5 per cent turnover rate for all personnel classifications during the year ended June 30, 1963. This represents an extremely low rate of loss and indicates a highly stable work force.

An analysis was made of the age distribution of engineering personnel for purposes of determining (1) potential losses by retirement, and (2) the apparent capabilities of the Commission to replace such losses. Table 9 shows the age distribution of all engineers currently employed. Analysis of these data reveal:

1. Thirty-three engineers (24 per cent) will reach retirement age within the next 10 years and can be expected to be lost to the organization.
2. The age distribution is such that replacements for retirees will be available from within the present work force — subject to additional recruiting for entrance-level engineers.

The fact that such a favorable age distribution exists indicates that (1) there has been a stable work force for some time, and (2) considerable planning has occurred in recruiting and placing engineers.

WORKLOADS

As shown in other sections of this report, the existing programming and scheduling processes have not resulted in an ability confidently to predict the workload that actually will be accomplished in many of the Commission's organizational units. There also has been no planning to balance workloads over periods of one or more years. As a result of these inadequacies in workload planning, the basis has not been provided for a solid evaluation of personnel requirements in accordance with the work expected to be accomplished.

The budget document itself — Table 8 — indicates that previous manpower complements are used as bases for determining future manpower needs: (1) the manpower authorizations for two prior years are shown, and (2) the total manpower authorizations for 1963 and 1964 remained the same despite increases and decreases in the complements for the separate personnel classifications.

MANPOWER ESTIMATES

Because the reorganization of the Commission's functional units recommended in this report will involve (1) new groupings of functions,

AGE DISTRIBUTION

Personnel Classification	Under 31 Years	31 to 37 Years	38 to 44 Years	45 to 51 Years	52 to 58 Years	59 to 65 Years	66 to 70 Years	Total	Per Cent
	Years	Years	Years	Years	Years	Years	Years		
Chief Engineer	0	0	0	1	0	0	0	1	0.7
Equipment Engineer	0	0	0	1	0	0	0	1	0.7
Highway Engineer VII	0	0	0	0	2	2	0	4	2.8
Highway Engineer VI	0	0	1	2	3	8	1	15	10.8
Highway Engineer V	0	3	6	2	8	10	2	31	22.4
Highway Engineer IV	0	7	6	6	4	4	0	27	19.5
Registered Highway Engineers	0	10	13	10	17	24	3	77	55.5
Highway Engineer III <u>3/</u>	0	1	2	5	1	3	0	12	8.7
Highway Engineer II	5	4	1	0	0	0	0	10	7.2
Highway Engineer I	20	0	0	0	0	0	0	20	14.4
Non-registered Highway Engineers	25	5	3	5	1	3	0	42	30.3
Materials Engineer VII	0	0	0	1	0	0	0	1	0.7
Materials Engineer VI	0	0	0	0	0	1	0	1	0.7
Materials Engineer V	0	0	1	0	1	0	0	2	1.4
Materials Engineer IV	0	2	2	3	0	2	0	9	6.5
Materials Engineer III	0	1	1	0	0	0	0	2	1.4
Materials Engineer II	0	0	1	1	0	0	0	2	1.4
Materials Engineer I	0	0	0	1	0	0	0	1	0.7
Materials Engineers <u>4/</u>	0	3	5	6	1	3	0	18	12.8
Total Engineers	25	18	21	23	19	30	3	139	N.A.
Per Cent	18	13	15	16	14	22	2	100	100

1/The number of engineers employed was counted as of November 23, 1964.

3/Persons in the Highway Engineer III classification may or may not be registered professional engineers.

2/The ages of the engineers employed were determined as of December 31, 1964.

4/Persons employed in the Materials Engineer classifications may or may not be registered professional engineers.

Data: Personnel records, State Roads Commission.

Table 9

DISTRIBUTION OF ENGINEERS BY PERSONNEL CLASSIFICATION 1/ AND BY AGE 2/

(2) greatly expanded functions of planning, programming and scheduling, and (3) changes in management positions, it is impossible at this time to make a firm prediction of future personnel needs.

However, there are some broad bases for evaluation, and these have been used to give an indication of the adequacy of the existing personnel complement and a rough estimate of future requirements.

Basically, there do not appear to be prospects for greatly increased workloads in most Commission units — judging from the programs presently contemplated. Thus, there probably will not need to be significant changes in the total work force. There may be over-staffing in some units and under-staffing in others, but this can be determined only from detailed studies.

It is known that there will be need for additional engineers and technicians in the recommended Planning Division and the Traffic Engineering Division. Additional professional and sub-professional personnel will be needed for the Organization and Management Services Division and the Personnel Division. In total, these needs will range between 25 and 35 additional personnel — including 18 to 20 in professional classifications.

In addition, there is a basis for judging that the Design Division presently may be under-staffed in the technician classifications and over-staffed in engineering classifications. The Bureau of Bridge Design employs one engineer for every technician, and the Bureau of Road Design employs one engineer for every five technicians. Many state highway departments employ too few technicians in relation to engineers — primarily because little has been known about the percentage of work performed in design divisions that should be performed by technicians and the percentage that should be performed by engineers.

Recent studies have indicated that design work is made up principally of tasks that can be performed by technicians. Proper staffing can be determined only through detailed manpower utilization studies. In design work, there also is the question of the most desirable use of consultants to augment the state's own personnel. Decisions can be made only on the basis of evaluating planned, balanced workloads.

The projected workloads relative to construction indicate that current manpower complements for the inspection and documentation of construction and for testing construction materials should be sufficient for the known future.

There are questions with regard to staffing for right-of-way acquisition — because future workloads cannot be estimated accurately with the present programming procedures — and for staffing maintenance, which requires a study of needs and staffing patterns.

However, with the rough basis for estimating that is available now, it does appear that additional personnel needs will be well within those provided by the currently authorized total personnel complement.

Analysis of the turnover that will result from retirements and resignations indicates that seven to eight per cent of the work force will have to be replaced annually. Replacements for the higher-level personnel classifications appear to be readily available from within the employee force and replacements for the beginning-level personnel classifications have consistently been obtained in the past.

The analyses of personnel management practices and procedures in the State Roads Commission lead to certain conclusions and recommendations.

CONCLUSIONS AND RECOMMENDATIONS

Within the existing framework of policies and procedures, there has been achieved a number of worthwhile objectives — employment based on qualifications, advancement based on objective examinations, salary management and discipline based on equal treatment for all state employees.

However, the present system may unduly limit the benefits to be gained — by individual employees and by the Commission organization — as compared with a system in which greater responsibility for personnel management is placed in line managers of the Commission. For example:

- There is no provision for merit increases.

The fact that all individuals receive automatic increases results in equal reward for below-average, average and above-average performance. It is not argued that automatic increases should be abolished, but it is suggested that there be provision for special merit increases for above-average performance. It should be a function of managers and supervisors to recognize highly meritorious performance.

- Performance appraisal as now carried on apparently is a perfunctory process.

The basic purpose of the existing performance rating system is not clear. Since increases are automatic, it does not appear that the ratings serve a function in salary management. Since promotions are based on examination scores which are not affected by ratings, it would appear that such ratings serve no purpose in the determination of promotions. There is no evidence that ratings serve to identify training needs or the need for disciplinary actions.

To be effective, performance review and appraisal should be directed primarily to the development of skills and abilities of personnel to (1) improve present performance, and (2) assure a reservoir of qualified

personnel to assume positions of greater responsibility. The existing system is not directed toward the accomplishment of these objectives.

- The existing system of personnel management does not allow the Commission (or its managers and supervisors) to select and promote personnel except from eligible lists which are developed by the State Commissioner of Personnel.

This process provides a certain degree of objectivity, but it also relieves operating management of a basic responsibility — that of identifying personnel with capabilities to advance, and developing these capabilities.

Policies should allow reclassification of positions and advancement of individuals within the discretion of the Commission, subject to sample post-audits by the State Commissioner of Personnel to assure compliance with the state-wide classification system.

Recommendation. Modify the existing personnel management laws, policies and practices to increase the personnel management participation by Commission managers and supervisors.

It is recognized that broad external controls should be retained to preserve positive aspects of the existing system. This recommendation envisages that existing provisions be modified to place in the Commission authority to (1) recognize above-average performance by special merit increases, (2) recognize outstanding performance by promotion of individuals, (3) reclassify positions subject to sample post-audit, (4) recognize below-average performance through salary-increase deferrals for periods up to one year without external review, and (5) reject probationary employees without restrictions other than those imposed by the Commission.

Implementation of these modifications will require the adoption of a somewhat different philosophy with regard to the Commission's role in personnel administration than now prevails.

Recommendation. Conduct studies that will provide information relative to the relationships that should exist between workloads and manpower needs and staffing patterns.

In order for the Commission, the Department of Budget and Procurement, the Governor and the General Assembly to know the number of

positions that should be provided in each personnel classification and organizational unit, there is need for reliable data relative to workloads and capacity to perform work. There also is need to know the staffing patterns that will provide for best utilization of manpower.

The steps required to obtain these data include:

1. Identification of the units of work — in terms used for project scheduling.
2. Identification of the numbers of units of work to be performed — also obtainable from project scheduling.
3. Identification of the manpower required to accomplish each unit of work — in terms of man-hours, design squad days, survey crew time and comparable units.
4. Identification of the staffing patterns that will best utilize the manpower — in terms of the proportions of tasks to be performed and the skills required to perform these tasks.
5. Calculation of the total manpower needs by classification and organizational unit.

Recommendation. Develop a performance appraisal system designed to improve managerial, supervisory and employee performance.

The appraisal system should have as its major objective the improvement of performance — as against identification of needs for disciplinary actions or salary-increase deferrals. Major elements of the appraisal should be as follows:

1. Identification of the major activities for which an employee is responsible and the standards of performance that have been adopted for these activities.
2. Identification of those activities that are being performed at standard, above-standard and below-standard.
3. Identification of the specific instructions and experience required to improve all performance to standard or better.
4. A rating of personal and behavioral traits and characteristics that constitute unusual assets and liabilities.
5. Evaluation of advancement potential — in terms of specific positions — and the training and experience required fully to qualify the employee for advancement.

6. A realistic and specific plan of action designed to overcome deficiencies, improve performance and develop advancement potential.

As can be seen, this type of appraisal would be subjective in character — not amenable to mathematical scoring. It would serve principally as a means of communication between supervisor and subordinate to ensure that the employee knows the tasks he is expected to perform, how well he is expected to perform these tasks, how well he is performing these tasks and the steps that will be taken to provide the training and experience necessary to improve his performance. It also would serve to provide the Commission with information relative to unused performance capacity, anticipated performance capacity and the training necessary to improve performance capacity — data essential for Commission-wide manpower inventories and manpower planning.



ROY JORGENSEN AND ASSOCIATES

